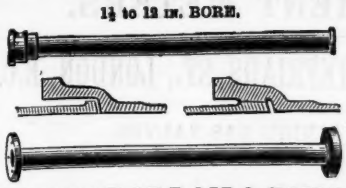
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXI. No. 1556.] LONDON, MARCH 7, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



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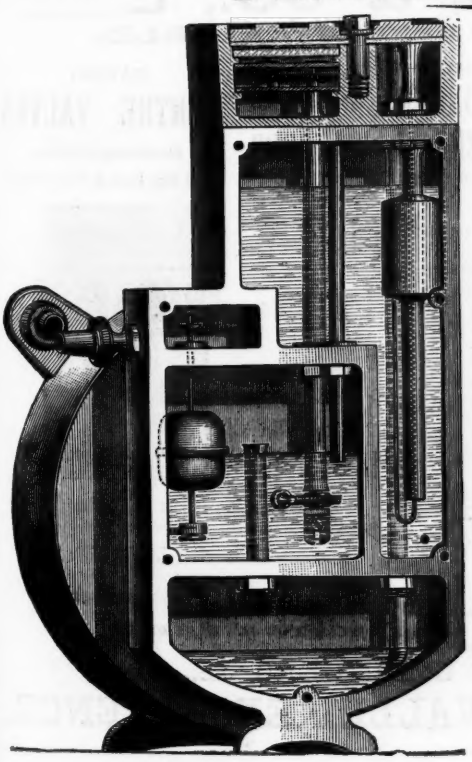
IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



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UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required, and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s., and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

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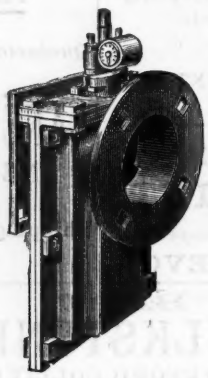

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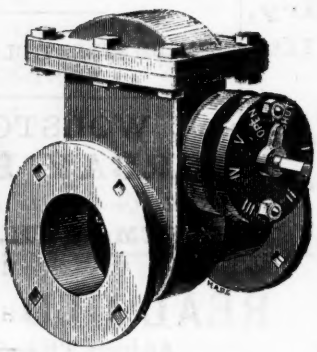

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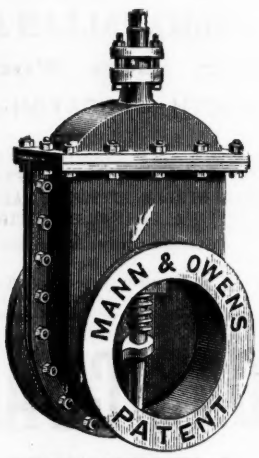

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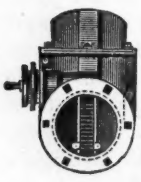

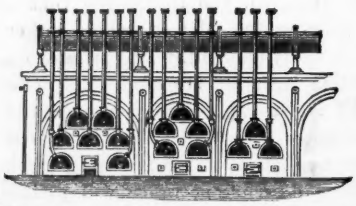

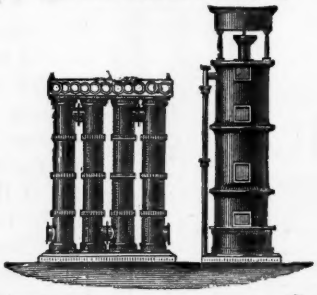

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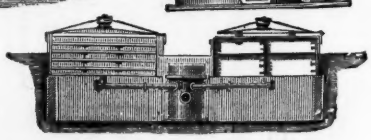

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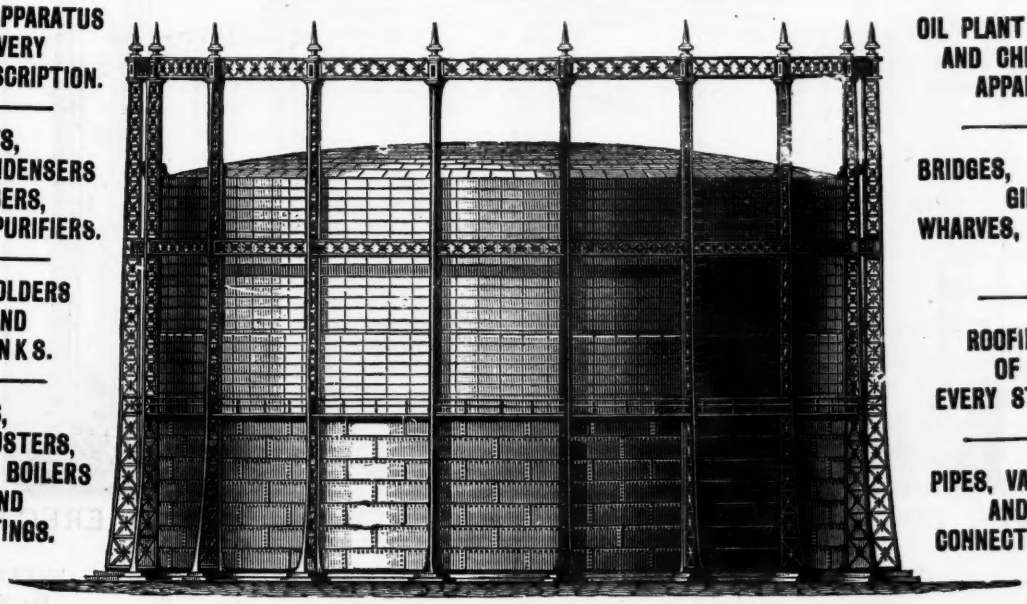

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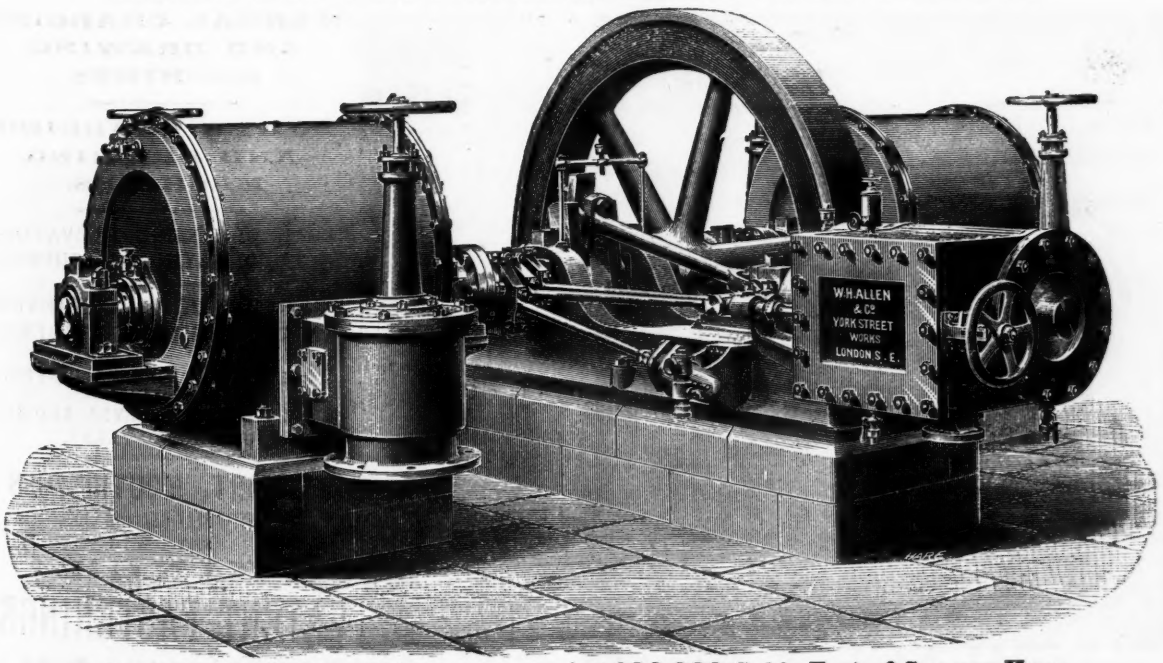

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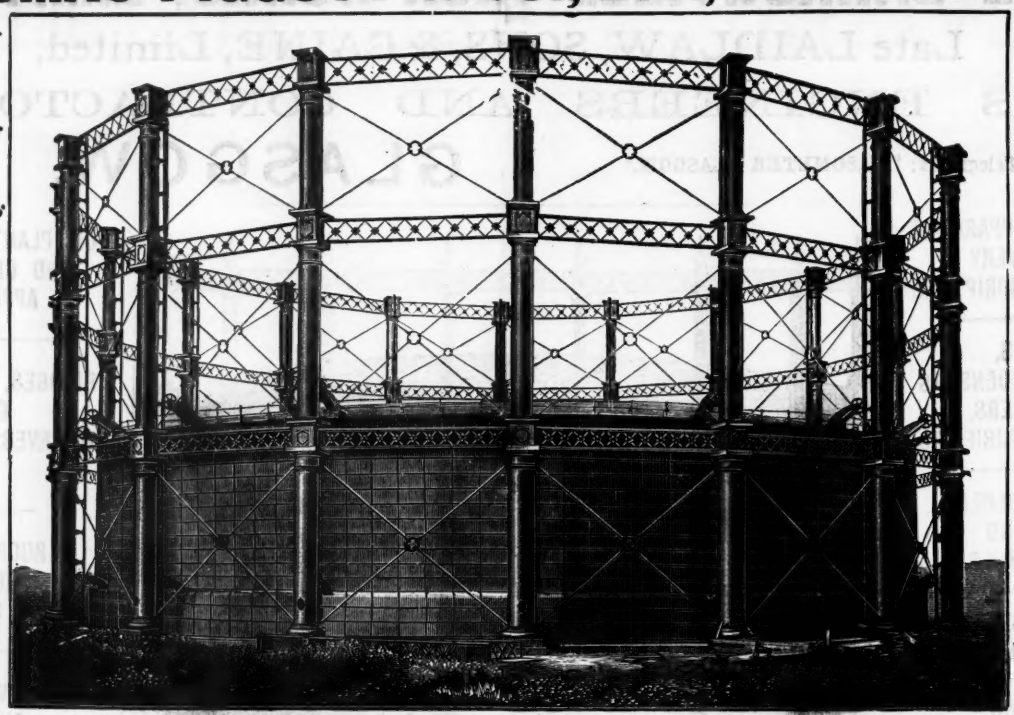

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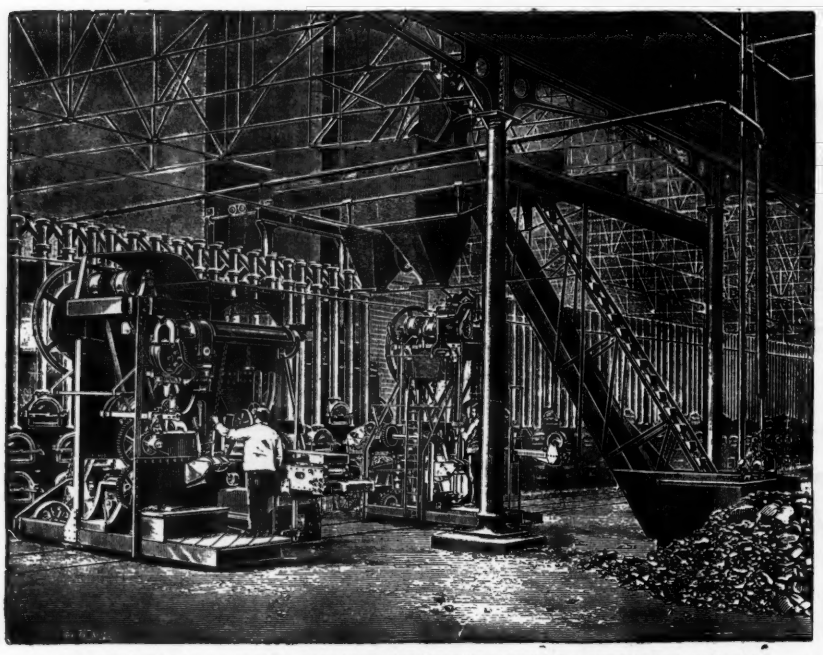
OVER **240** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.



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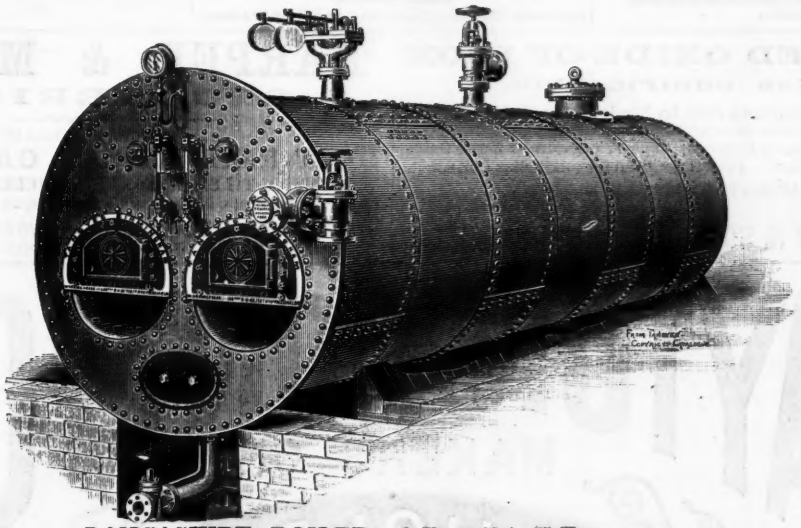

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MADE OF BEST MILD STEEL PLATES, BY SPECIAL MACHINERY,

IN THE

Lancashire, Cornish, Vertical, Colonial, and Semi-Portable types. Maximum working pressures varying from 70 to 160 lbs. per square inch, according to type.

TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM.

AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, GENOA, BILBAO, AND ROTTERDAM. No. 91 E.

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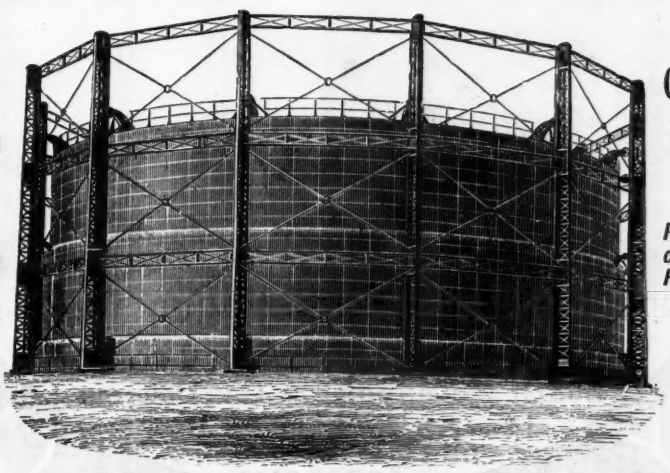
THE
PATENT ROTARY
Scrubber-Washer,
With recent improvements.

Sizes from 50,000 to 5,000,000 feet per day.

Guaranteed larger area of wetted surface, size for size, than that of any other Maker.

RESULTS UNAPPROACHED BY ANY OTHER SYSTEM.

Send for References.



Single, Double, Treble, and Four-lift Gasholders of all Sizes.

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COMBINED EXHAUST REGULATOR & TAR EXTRACTOR,

Perfectly automatic, and cannot get out of order. Prices low. All particulars on application.

Retort-Settings, Condensers, Scrubbers, Purifiers, and all Fittings for Gas-Works.

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FOR GAS PURIFICATION.
Two to three times as rich in Hydrate as Bog Ore.
STRONG ACTION ON SULPHURETTED HYDROGEN.
We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.
LESS THAN HALF THE PRICE OF BOG ORE.
APPLY TO—
READ HOLLIDAY & SONS, LTD., HUDDERSFIELD.

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MANUFACTURERS OF
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MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND
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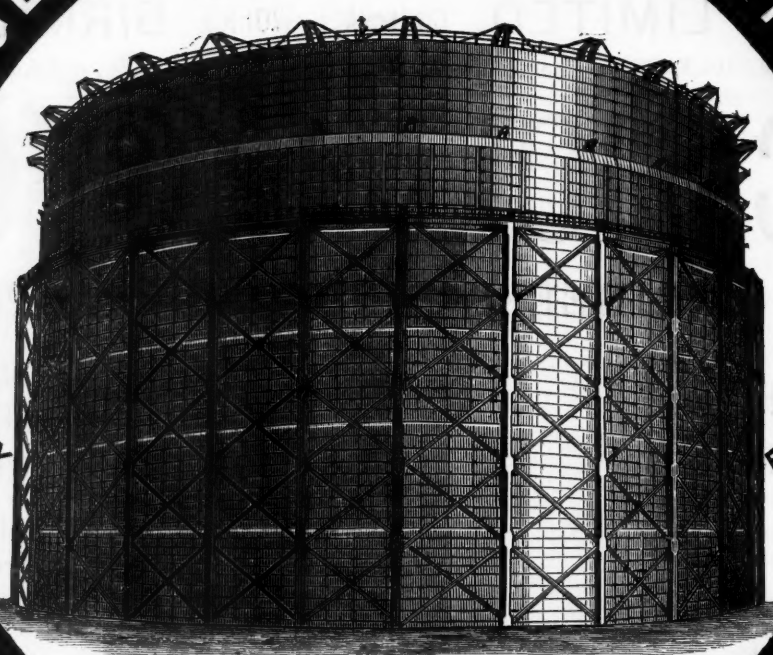
THE LARGEST GASHOLDER IN THE WORLD
GASHOLDERS OUR SPECIALITY



DESIGNED BY FRANK LIVESEY ESQ.
CAPACITY 12 MILLION CUBIC FT.
ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAR.
MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO
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TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE
ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

KIRKHAM, HULETT, & CHANDLER,

LIMITED.

(SIDNEY HERSEY, Managing Director.) (J. CHANDLER, Engineer.)

PATENT

"STANDARD" WASHER-SCRUBBER.

459

of these Machines (capable of dealing with 437,315,000 cubic feet of Gas daily) erected and in course of construction. These facts are given as evidence of the apparatus being the most efficient of any in the market for the extraction of

AMMONIA, CARBONIC ACID, AND SULPHURETTED HYDROGEN FROM COAL GAS.

A large number of the above Machines have been constructed according to the Company's latest Patent, which has also been applied to original pattern Machines at many Works.

TESTIMONIALS.

The Gaslight and Coke Company,
Horseferry Road, Westminster, S.W.,
Nov. 25, 1889.

Messrs. KIRKHAM, HULETT, AND CHANDLER, LTD.,

Gentlemen,

In reply to your inquiry respecting the result of putting Wooden "Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.

I am, yours truly,
(Signed) G. C. TREWBY.

NOTE.—Orders since received for four 3,500,000 cubic feet per day Machines for Beckton; and two 3,000,000 cubic feet for Kensal Green, also for Patent Improved Wooden "Bundles" for original pattern Patent "Standard" Washer-Scrubbers erected at Beckton, Nine Elms, Shoreditch, Pimlico, and Bromley.

Extract from the JOURNAL OF GAS LIGHTING, &c., for Sept. 27, 1892, referring to the visit of the Members of the Eastern Counties Gas Managers' Association to the Lowestoft Gas-Works—

"Mr. J. Ayris has one of Messrs. Kirkham, Hulett, and Chandler's "Standard" Washer-Scrubbers in operation (capable of dealing with 500,000 cubic feet of gas per 24 hours); and of the working of this machine he spoke very highly."

Estimates furnished for cost of altering original pattern Patent "Standard" Washer-Scrubbers, or for the supply of New Machines.

ADDRESS:—

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PENNY-IN-THE-SLOT PREPAYMENT GAS-METERS.

Gas is probably one of the most important of the many commodities for the delivery of which automatic mechanism has been devised. The system as applied to gas is not only useful to the public, but it also secures to Gas Companies and Corporations a new source of revenue free from the risk of bad debts.

In the United Kingdom alone, there are hundreds of thousands of householders who do not burn gas, and of these a large proportion, especially in manufacturing centres, purchase their light, whether oil or candles, in small quantities, and cannot be persuaded to adopt gas because of their disinclination or inability to meet the payment of periodical gas bills.

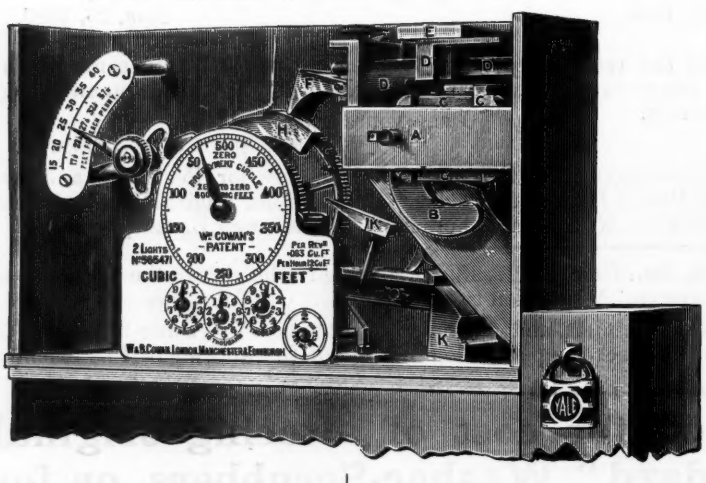
The Prepayment System by means of our *Patent Penny-in-the-Slot Prepayment Meters* entirely removes this difficulty, because it enables the consumer to purchase at pleasure a pennyworth of gas just as he would buy oil to the same value.

Once such a meter is fixed in a house, it may remain there permanently, no matter how many changes of tenancy may occur, or how often, as each successive tenant who finds such a convenient Meter in his house readily takes to the idea, and patronizes the Penny-in-the-Slot Meter instead of the oil seller. This, in itself, will be a great convenience to gas officials, relieving them of the trouble of arranging for a gas supply to each successive tenant, and of all considerations as to their credit.

Our Patent Meters are constructed on the most reliable and approved principles, and give the greatest satisfaction to both the seller and the buyer of gas. A distinctive, and, indeed, an essential feature of our Meter is the *price-adjusting mechanism,* by means of which the inspector can readily adapt the Meter, *in situ*, to a change in the price of gas by altering the position of the pointer I on the graduated scale J, which is, of course, under seal. Since their comparatively recent introduction, we have supplied several thousands of these Meters to many large and small gas undertakings; and the public demand for them is rapidly increasing—their operation being at once simple and effective.

The reference letters to one of the annexed illustrations of our Penny-in-the-Slot Dry Meter indicate the different parts of the mechanism.

These Meters may be made to suit coins of various values.



DIRECTIONS.
PUT A PENNY IN THE SLOT AND THEN TURN THE THUMB PIECE AT THE FRONT OF THE METER COMPLETELY ROUND SO AS TO BRING THE POINTER ATTACHED TO THE HANDLE BACK TO ITS ORIGINAL POSITION OVER THE ARROW.
W. B. COWAN
LONDON
MANCHESTER
EDINBURGH
GAS METER MANUFACTURERS

A—Shaft for Handle.
B—Eccentric.
CC—Eccentric Box.
DDD—Coin Carrier.
E—Coin Slot.
F—Pawl.
G—Prepayment Wheel, with Stop-Pin.
H—Price-adjustment Platform.
I—Pointer.
J—Price-adjusting Scale.
K—Stop Lever.

GENERAL DESCRIPTION.

The operating handle can only be turned in one direction; and a complete revolution of it is required on each occasion.

In order to permit of the recession of the stop-pin of the prepayment-wheel from the stop-lever of the meter, the attachment of the wheel to its shaft is not rigid but frictional. This friction is overcome when the advancing pawl gears into the teeth of the wheel, and recedes the stop-pin from the stop-lever.

Each coin which is inserted, and passed into the money-box by operating the handle, places a supply of gas equal in value to the coin at the consumer's disposal; but no *effective* action of the handle can take place unless the appropriate coin has been passed into the slot.

By operating the handle for each coin, a number of coins may be successively passed into the money-box; and their total value in gas be made available for present or future use. But when the prepayment-dial shows that 450 cubic feet have been paid for, and are still unconsumed, no more coins must be inserted till some part of the gas at disposal has been used.

The prepayment-dial is intended to be a guide to the consumer as to the quantity of gas his coins have paid for, and also to inform him when the supply at his disposal is about to cease.

With a coin in the slot, the movement of the handle becomes effective, causing the pawl F to advance, move round the prepayment-wheel G, and with it to recede the stop-pin from the stop-lever K. The extent of the movement given to the wheel by the pawl depends on how much of the "travel" of the pawl is allowed to operate on the wheel. The price-adjustment platform H (the position of which is determined by the setting of the pointer I in relation to the scale J) supports the pawl off the teeth of the wheel during more or less of the movement the pawl has. If, therefore, the adjustment platform be well forward, the movement of the pawl will produce comparatively little effect on the wheel; but, if the platform be so placed that the pawl almost immediately gears into the wheel, the wheel's movement will in that case be almost equal to that of the pawl. As the extent of the wheel's movement determines the amount of the recession of the stop-pin from the stop-lever, it follows that the quantity of gas supplied for each coin may be varied according to circumstances, because it is determined by the setting of the pointer in relation to the scale J. The pointer moves and fixes the platform, whilst the scale determines the position in which the pointer is to be fixed; and this is made to suit the price of gas in operation at the time.

The importance of our system of price-changing will be evident to all who consider how inconvenient and expensive would be the employment of slot meters without such a provision. It was this consideration that made it absolutely necessary to devise means whereby the necessary alteration of the mechanism to suit changes in the price of gas would be practicable, *on the consumer's premises, and with no loss of time.* The particular method here shown and described is only one of several modifications of the principle for which we hold exclusive patent rights.

Prices and Further Particulars on Application.

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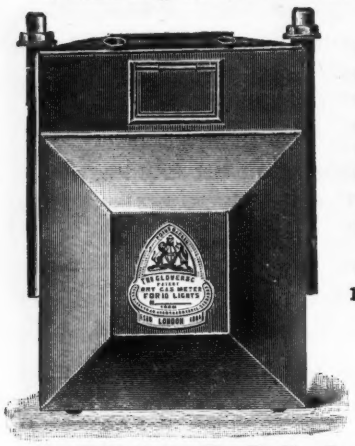

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2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
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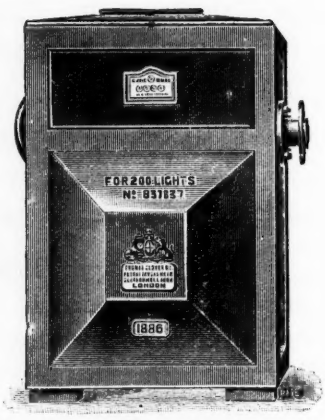

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0, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic: Address "PRECISON."
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 7, 1893.

The Cost of Meddlesome Local Legislation.

At last the chiefs of the Liberty and Property Defence League, who have for years been even as they who cry in the wilderness, must feel themselves justified of their adversaries. This association, the head of which is Lord Wemyss, reunites in its membership statesmen and politicians of all colours and qualities who agree in holding, with an immortal creation of the late Artemus Ward, that "we are governed too much." Private Bill Legislation has furnished a great deal of *pabulum* to the League, whose annual reports recount with merciless particularity the attempts of Local Authorities throughout the United Kingdom to extend the general law by special enactments for their own districts. Thanks largely to the efforts of the League, the last Parliament adopted the plan of appointing a Committee on Police and Sanitary Regulations, to whom all Private Bills promoted by Municipal and other Local Authorities containing provisions for altering or extending the general law were remitted; and the Committee were instructed to take cognizance of these innovations in a systematic manner. This device has recommended itself to the present Government; and the necessary steps have been taken for continuing the system. Upon the resolution to this effect coming before the House of Commons, Mr. Fowler took the opportunity for calling attention to the whole subject of Private Bill Legislation, as initiated by Local Authorities, in a speech which must have gladdened the heart of Lord Wemyss. What the blind partisans of Municipalism in the House thought of it, there is no means of knowing, inasmuch as none of them made any attempt to answer Mr. Fowler; but the speech is eminently one to be made a note of, against the time when a fresh proposal shall come forward for enabling Local Authorities to do whatever they please in promoting or opposing Private Bills at the ratepayers' expense.

Mr. Fowler's indictment of the parliamentary proceedings of Local Authorities was twofold. He first accused them of seeking to do all sorts of unjustifiable things under cover of special legislation; and next of squandering the ratepayers' money in doing by Bill what could be better and more cheaply effected by Provisional Order obtained from the Local Government Board. Mr. Fowler declared that all sorts of fantastic changes in the general law are attempted by local bodies. He stated that, in his opinion, most if not all legitimate sanitary questions affecting local government areas can be dealt with by the Local Government Board by means of bye-laws. But this does not please many Town Councils and Local Boards. They must needs have their *omnibus* Acts, in which every little point of sanitary or police regulation has the dignity of a clause to itself. If all the matters that are proposed in this way as fit subjects for the consideration of Parliament in only one session are seen collected together, as they are in the publications of the League already named, the perusal of them is distinctly amusing—for those people who have not to pay the necessary expenses of their enactment or rejection. We have in mind a certain measure now awaiting consideration by which a Corporation seek power to provide, among other things, "nurses for attend-"ance upon the members of any family suffering from any "infectious disease." Since puerperal fever is an infectious disease, this provision may cover the establishment of a corps of municipal midwives—which goes rather beyond "grandmotherly legislation," as the term is usually understood. There is no end, however, to the vagaries of the Parliamentary Committees of Local Authorities, where these bodies are influenced by "progressive" ideas.

And the expense of all this! Mr. Fowler said that during the past six years local bodies have spent £473,000 upon Private Bill Legislation, exclusive of all costs incurred in connection with Railway Bills; and he declared that "five-"sixths of that legislation could have been more success-"fully carried out by means of Provisional Orders at com-"paratively little expense." Descending from the general to the particular, the speaker said that, "in one case that "had recently come before him, the rateable value of the "district to be affected by a local Improvement Bill "promoted by the Local Authorities was only £7400 per "annum, and the cost of the Private Bill Legislation that "had been necessary (?) to effect the improvement sought "to be made under it was £4000." Mr. Fowler suggested, as a probably efficient check upon local extravagance, that parliamentary expenses should be defrayed at once instead of being spread over a period of some ten years. All this is a significant comment upon the modern "progressive" doctrine that local Authorities can do no wrong.

The truth was fairly put by Mr. Fowler when he said that "this private legislation for local purposes is be-"coming fraught with danger." The evil has numberless sources; but we take leave to mention one that unquestionably goes for a good deal. This is the deputation system, as fostered by fussy and ambitious town clerks. There is no glory, and but little profit, to be made by the officials concerned, out of a Local Government Board inquiry. It is ever so much more agreeable to come up to

the Hotel Victoria, or even to the old Tavistock, and dance attendance at St. Stephen's, than to sit with an Engineer Inspector in a committee-room of the local municipal buildings. Of course, this is a horribly low and ungracious way to look at the matter; but there is much to be said for it. Ratepayers can hardly deal with this matter, for want of the necessary knowledge. The best result would perhaps be achieved by surcharging a few town councillors with the expenses of unnecessary applications to Parliament; but we hardly expect to hear of any such strong action being taken by the Local Government Board. Let us hope that some good will be done by Mr. Fowler's announcement that he has his eye on the matter.

The Judgment in the South Metropolitan Nuisance Suit.

Lord Justice Smith gave judgment yesterday in the important South Metropolitan nuisance suit; finding against the Company on all the issues left to him, and granting to the plaintiff the injunction prayed for, with costs, but not on the higher scale. An inquiry as to damages is ordered, subject to liberty given to the defendants to satisfy the plaintiff in this respect by the offer of a lump sum, with a view to saving the costs of the reference. The Company cannot be congratulated on the result of their decision to fight the case; but the judgment will not come as a surprise to anyone who has attentively followed the proceedings in Court. The fact that specific damage had been done (mainly by sulphuretted hydrogen in the air) to the plaintiff's property since November, 1891, was sworn to by seventeen witnesses; and, short of convicting all of these of perjury—which was not attempted—it was quite impossible to remove the impression made upon the Court by such a mass of testimony, reinforced as it was by several undeniably damning exhibits. Disputation raged more particularly over the questions as to where the sulphuretted hydrogen came from, and whether, supposing it to have emanated from the gas-works, its production was anything illicit and actionable. We cannot pretend to summarize the evidence given on both sides upon these points. Enough to say that in his judgment—which we shall give in full next week—the learned Judge went very carefully through all these matters, in order, as he admitted later, to stop further litigation. The case appears to have been very fairly fought on both sides. Whether it should have been fought at all, is a question respecting which bystanders' opinions may differ. The losers have three weeks to consider their position and decide upon their future action; and, in view of the possibility of an appeal, we will say no more respecting the merits of the matter. As a noteworthy feature of the hearing, it may be mentioned that, although he was not assisted by an expert assessor, which was indeed hardly to be expected in such a case, the Judge fortified himself for dealing with the issues of fact by personally visiting and inspecting the scene of the alleged damage, after he had taken the bulk of the evidence on both sides.

The Manchester District Institution Meeting.

The members of the Manchester District Institution of Gas Engineers met in Manchester last Saturday, when Mr. C. Armitage, of Lancaster, relinquished the chair, on the termination of his year of office, in favour of Mr. W. R. Chester, of Nottingham, who delivered the Inaugural Address which will be found in another column. This is a composition of much general interest, and goes upon lines very suitable for a presidential address to a District Gas Managers' Association. It has come into our hands too late, however, to be thoroughly criticized in the present issue of the Journal. The usual routine business was transacted by the meeting, which we hope was the beginning of a prosperous year for the Institution. Before bidding farewell to Mr. Armitage in his official capacity of President of the Institution, we desire to draw attention to the interesting statement he offered on Saturday upon the ever-pressing subject of sulphur purification. All gas-works chemists, and many engineers who, with respect to sulphur in gas, are compelled to be chemists in spite of themselves, will unite with Mr. Armitage in the aspiration that "the day is not far distant when we shall be in full "possession of the information [respecting what actually "goes on inside a lime-box], in order that we may be "enabled to offer to the public coal gas in which the most "fastidious cannot find any cause whatever to complain." Meanwhile, it is not too much to ask gas managers to put themselves right with the public by sending out the purest gas they can make, having regard to all the circumstances, and at the same time to beg the public to forbear asking for impossibilities. We have no desire to poke fun at Mr. Armitage or his brother chemists, who are able to extract, from writing down elaborate chemical formulæ, a degree of comfort comparable only to that derived by the old lady from "that blessed word Mesopotamia;" but we may be permitted an expression of thankfulness that the procession of symbols which Mr. Armitage marshals across a column only means "the addition of water" to the contents of a sulphide-box.

Railway Rates in Parliament.

The subject of railway and canal rates and charges and the conditions of traffic was discussed at some length in the House of Commons last Friday evening, upon the initiative of Sir Albert Rollit, Chairman of the Associated Chambers of Commerce, who moved a resolution to the effect that the new arrangements made by the Railway Companies since the beginning of the year are most prejudicial to the industries and agricultural and commercial interests of the country, and urged upon the Government the necessity of dealing promptly and effectively with the subject by legislation, declaring unreasonable rates, charges, and conditions to be illegal, and establishing a cheap, simple, and expeditious mode of determining, in case of dispute, what are reasonable rates, charges, and conditions. Sir A. Rollit assumed that, under the revision, the Railway Companies have managed to get from 15 to 20 per cent. more for the carrying of goods than was paid before. The motion was strongly supported on behalf of the traders, but was sharply criticized by Sir Julian Goldsmid and Mr. Plunket, speaking as Railway Directors. The whole debate was a good example of how businesslike the House of Commons can be when it allows a special subject to be dealt with by specialists. Eventually, Mr. Mundella, President of the Board of Trade, repeated his indictment of the Companies for having broken faith with the Department by converting maximum into actual rates. He said that the understanding certainly was that there should be no general raising of rates; and it is only fair to Sir Julian Goldsmid to record that in his speech he expressed his disapproval of this proceeding. For the Government, Mr. Mundella asked the House to pass that part of Sir A. Rollit's resolution which declared that the subject ought to be promptly and effectively dealt with; but he pointed out that if the whole of the resolution were passed it would tie the hands of the Government, and postpone indefinitely the chance of obtaining the relief demanded by the traders. As an alternative, he proposed that time should be given to the Companies to revise their rates, and that, when the result appears after Easter, a Committee of the House shall be appointed to see what has been the effect of the change, and how the matter can be most effectively dealt with in the future. This course was taken; and consequently the Companies will have a certain period of grace to enable them to come to terms with their customers, on peril of legislative interference, which would be sure to bear hardly upon them. It is to be hoped that the country will be spared the humiliating spectacle of the Railway Companies being arraigned before Parliament for contumacious disregard of the expressed desire of the House in this matter.

The Eight-Hour Day for Miners.

The Miners' Federation of Great Britain and the Aberdare and Merthyr Association of Miners have had, through their leaders, an interview with Mr. Gladstone and the Home Secretary, for the purpose of asking Government support for the Miners' Eight Hours Bill. Before they escaped from the grasp of the "Old Parliamentary "Hand," however, the artless members of the deputation permitted certain admissions of weakness to escape them, of which the Prime Minister took full advantage. It is not denied by Mr. Gladstone himself that, irrespective of his own predilections, he will go a very long way with any considerable body of voters who have fully agreed to ask him, as with one voice, to adopt a certain policy. It is essential, however, that there shall be no suspicion of want of unanimity among his suppliants. Upon the first appearance of divided counsels, the Premier is on his guard; and when the object which is sought to be commended to him is not altogether grateful to himself, he never fails to lay stress upon the existence of the disagreement as supplying good reason for declining to support the

general proposal. And it soon appeared that, while both the powerful miners' organizations who approached him last Friday were in apparent agreement as to the desirability of legalizing an eight-hour day, they were at variance as to the meaning that should be given to the term. The Miners' Federation wants the time to be reckoned "from bank to bank;" while the Welshmen ask that it should mean the time that is actually occupied in working "at the face" of the coal. But this is not the only difference of opinion that exists among miners on the eight-hour question; for it is notorious that the great majority of the men employed in the coal industry in Northumberland and Durham do not want any statutory restriction of their working hours at all. As *The Times* puts it, very neatly, "they are for leaving things as they are; the "remaining districts of the Federation wish to alter them "in one way, and the Welshmen wish to alter them in "another." It is easy to imagine what a fine opportunity this division of opinion gave Mr. Gladstone, who is, after all, an old Free Trader and non-interventionist in regard to industrial matters. He assured the miners that, until they can show that something like "moral unanimity" on the question prevails in their own ranks, they will never prevail upon Parliament to pass a compulsory Eight Hours Bill. The way in which the wary old statesman—first of living debaters—turned the spokesmen of the miners' deputation inside out, recalls his similarly adroit treatment of the even more heterogeneous deputation of the London Trades Council which he received last June. The case of the miners, of course, occupies a different footing from that of the "universal eight hours" men; but so long as even a minority in numbers of the men engaged in the mining industry protest against legislative interference with their hours of labour, it will need stronger arguments than any that have yet been advanced to induce the Legislature of a free country to override their claim to work in their own way. Industries of every kind are, of course, subject to the law of the land; and the methods by which they are carried on, and the working hours of those engaged in them, can be regulated, upon sufficient cause being shown, in the interests of the public health and safety. To ask the law to say that one man shall only work six, seven, or eight hours merely at the bidding of another man who may happen to think that such a restriction would be good for them both, is, however, a demand that goes beyond sanitary or police legislation. Laws of this kind are occasionally passed by the sovereign States of America, with the invariable result of their being ignored or evaded by the people. This is mere playing at legislation; and no one can seriously wish for the Parliament of the United Kingdom to be reduced to such an occupation.

Mr. J. E. Hall, Assistant to Mr. J. Booth, of Southport, has obtained the appointment of Assistant-Engineer, for which applications were recently invited in our advertisement columns by the Gas Lighting Improvement Company, Limited.

Mr. W. Weston, foreman in the service of the Chelmsford Gas Company, has been selected by the Directors of the Canterbury Gas and Water Company to fill the position of storekeeper and foreman advertised in the JOURNAL for Jan. 17 last.

The Velocity of Gas through Purifiers.—With reference to the "Note" on this subject which appeared in the JOURNAL last week, a correspondent has pointed out that the credit for the arrangement there described, which is not new, is really due to Mr. G. Anderson.

Death of Mr. D. M. Irons.—It is with regret that we announce the death on the 20th ult., after a short illness, of Mr. David M. Irons, the Manager of the gas-fittings department of the Portsea Island Gas Company, and son of Mr. G. B. Irons, the Manager of the Gosport Gas Company. Deceased was 34 years of age.

Eastern Counties Gas Managers' Association.—We have received from the Honorary Secretary and Treasurer of this Association (Mr. H. Wimhurst, of Sleaford) the programme of the ninth general meeting, which, as stated in the JOURNAL last week, will be held at Cambridge on the 15th inst. By the kind permission of the Mayor (Mr. S. L. Young), the business will be transacted in the Council Chamber. It will comprise the election of a new member (Mr. J. Dixon, of North Walsham), the adoption of the report and accounts, the delivery by the President—Mr. W. Duesbury, the Manager of the Cambridge Gas-Works—of his Inaugural Address, and the reading of a paper on the "Protection of the Gas Engineer," by Mr. J. A. Fielding, of Waterbeach. At the close of the proceedings, the members and friends will dine together at Ye Olde Castel Hotel. On the following morning, the members will accept the invitation of the Directors of the Cambridge Water Company to pay a visit to their works.

WATER AND SANITARY AFFAIRS.

THE evidence given before the Royal Commission on the Metropolitan Water Supply by Mr. Edward Easton affords many confirmatory facts of a striking character as to the existence of a large amount of underground water in the chalk. The evidence is specially remarkable as indicating an actual subterranean flow towards the sea. The absorption into the chalk in the watersheds of the Thames and the Lea is reckoned by Mr. Easton as being equal to 12 or 16 inches per annum. Streams issuing from a chalk area are reduced in volume by the quantity of water which gets away through underground channels towards the nearest outlet. The experience of engineers, geologists, and even millers, is cited, to the effect that the water-ways of chalk streams are very much smaller than those of streams coming off clay lands. It is mentioned that when a well in the Patcham valley, contiguous to the Brighton Railway, overflowed under the influence of heavy and continuous rain, the chalk on the surface not flooded by the overflow was quite dry. As a rule, the water in the well was 50 or 60 feet below the surface, and at the time referred to the underground water at Brighton was running into the sea through the beach to an extent which it was not practicable to measure. We believe the same phenomenon may be observed on various parts of the south coast. Mr. Easton stated that between Dover and St. Margaret's Bay, where there was no beach upon the chalk, the springs had been measured which ran out at low water; the total quantity in the month of January exceeding 6,000,000 gallons per day during the three days of observation. Whatever argument may be adduced to dispose of these facts, there seems every reason to conclude that not only is there a large store of water in the chalk, but a copious flow, extending not merely below the surface of the ground, but beneath the river beds. Mr. Easton suggests the existence of an underground stream derived from the uncovered chalk which is without open streams in the upper part of all the chalk areas. An idea is entertained by Mr. Easton that probably such subterranean water is going "straight under London," though he acknowledges that "this is indeed a difficult question." His conclusion is that the estimates formed by himself and others of the quantity of water obtainable under London are the minimum, and that much more could probably be procured. In connection with Mr. Easton's evidence before the Royal Commission, we should like to refer to Mr. Binnie's report to the London County Council on "The Flow of the "Thames." In recently discussing this report, we quoted Mr. Binnie's figures, showing that, with a rainfall averaging 27 inches per annum in the Thames Valley above Teddington, the "flow from the ground" was only about 8·5 inches. Hence 18·5 inches had gone elsewhere—a volume concerning which Mr. Binnie could give no account, except that it had "evaporated," with or without assisting in the development of vegetation. The drainage area over which Mr. Binnie's observations extended consisted of 3789 square miles. This would therefore include various surface soils. But it seems as if a good deal of the water concerning which Mr. Binnie says he "failed to find any trace" may have gone to swell the bulk of some of those underground streams of which Mr. Easton has knowledge, situated in the valley of the Thames. The gaugings near Dover may have nothing to do with London; but the law which governs the discharge from the chalk in one place may be expected to prevail elsewhere. Over eleven square miles of the Dover area, it was shown by the delivery of the water that there was an absorption last year of 12 inches of rainfall—yielding 5½ million gallons of water daily; while on a contiguous area of 4 square miles, the absorption amounted to 18 inches. A little more technical precision in Mr. Easton's evidence may be desirable; but the broad facts are sufficiently clear.

Inclined Retort System Patent Rights.—A case has just been settled by the Comptroller of Patents, in which the Automatic Coal-Gas Retort Company opposed the granting of a seal to an application for patent No. 21,249 of 1891, for charging inclined retorts, applied for by Mr. E. Drorg, or Drory, Engineer of the Imperial Continental Gas Association's Vienna works. The applicant did not appear; and the Comptroller refused the seal on the ground that the invention was already covered by the Automatic Coal-Gas Retort Company's patents. The patent in question was described in the JOURNAL for Oct. 25 last (p. 729).

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 429.)

THERE is no improvement to be noted in the position of matters on the Stock Exchange; the tendency being, if anything, rather in the opposite direction. There is renewed depression in Irish securities; and the apprehension of a disagreeable agitation in Parliament with regard to rates has sent railway stocks a little lower. On the other hand, the Transatlantic railway position has somewhat mended. On the whole, however, there is more to depress than to elevate one's expectations; and business has thus been kept very low. Investment stocks must still be excepted from the general category; the demand for them continuing to be very brisk. This is likely to be the case, in view of the protracted ease of the Money Market, and of the deterrent effect upon speculation exerted by agitation and apprehension. The Gas Market has been a little more active than in the preceding week; and general firmness is still very marked. Several quotations have made appreciable advances in value. The Metropolitan undertakings more than maintain their position in public favour. Gaslight "A" has not moved, but has been very steady all through the week at close figures. The secured and limited issues were active, and changed hands at improving prices; the 4 per cent. debenture being done at the high figure of 125—a price which returns less than 3¼ per cent. for money. South Metropolitans have been moderately dealt in at good figures; and the "A" shows a further rise of 4. Commercials have been untouched; but higher prices are being asked for both the old and the new stocks. This seems to bear out fully our observations of last week as to the view entertained in the market with regard to a moderate and prudent diminution in the dividend rate. The Suburban and Provincial Companies furnished an average amount of business, and stood very firm all round; but nothing moved, except Brentford old, which made a further improvement of 1½. This advance likewise emphasizes the view expressed above as to moderate dividends. All the Continentals were strong; Imperial regained the lost point of the preceding week, and Europeans advanced. Movements among the rest are somewhat irregular; Malta and San Paulo being better, but Oriental relapsing. The Water Companies have been quieter; but the general firmness is well maintained, and what few changes in quotation are observable are in the upward direction.

The daily operations were: The Gas Market opened on Monday with a good show of strength; and, though business was somewhat restricted, material advances were effected. Both Commercials rose 2; Gaslight "H," 1; and San Paulo, ½. On Tuesday the position was maintained, but was not pushed farther; and quotations closed unchanged. Progress was made on Wednesday, when South Metropolitan "A" gained 2; Brentford old, 1½; and European, ¼. Southwark Water was 1 higher. On Thursday business was chiefly in Imperial Continental, which advanced 1; very little else being dealt in. Further improvements were freely effected on Friday. South Metropolitan "A" rose 2; Gaslight 4 per cent. debenture, 1; both Europeans, ½; and Malta, ¼. Oriental, however, receded ½. Saturday presented no particular feature; and the only change was an advance of 2 in West Middlesex Water.

ELECTRIC LIGHTING MEMORANDA.

Proposed Parochial Electric Lighting Scheme for Lambeth—The Glasgow Municipal Electric Light Undertaking—Overhead and Underground Electric Wires—The Ventilation of Electrical Subways.

As already announced in the JOURNAL, the Vestry of Lambeth are contemplating carrying out a central station electric lighting scheme for the parish, at an estimated capital cost of £300,000, though it is proposed to let the ratepayers down easy by spending only a quarter of this amount to begin with. As we remarked the other day with reference to the case of Tunbridge Wells, there is a marked tendency on the part of electricians consulted by local authorities in the matter of carrying out Electric Lighting Orders to advise something small "to begin with." These gentlemen have enough of the wisdom of the serpent to know, and to act upon the knowledge, that "it is only the first step that costs." Once get the thing started, and local authorities may be trusted to go forward rather than to retrace their steps—which latter course is, as a matter of fact, practically impossible in their case. To confess to having made a mistake is something that no majority of a local authority ever did yet, when the blunder has to do with the squandering of the ratepayers' money. Mr. W. H. Preece is advising the Lambeth Vestry in this business; and, having regard to the fact that the parish has a large population of the very poor, he has set himself to develop, for the behoof of the Vestry, his brand-new idea that the incandescent electric lamp is the "poor man's light." It is quite possible that he may win his way with the Vestry; for experience tells us that, once a popular representative body have set themselves to commit an act of extravagance, they accept any balderdash as sound argument in its support.

The opening of the municipal electric lighting undertaking of the Glasgow Corporation, as we reported last week, was made the occasion of a good deal of mutual felicitation on the part of the municipal magnates and the public. This is all very right and proper; for the Glasgow Corporation already did so much for the city that it was impossible to resist the case for a Corporation electric lighting station or two, as might be required. We are quite willing to go further, and admit that, if municipal intervention in the matter of electric lighting supply is permissible anywhere, it is so in Glasgow. It is difficult to say what the Corporation might not do for the city, upon due application. With regard to the electric lighting venture, we desire to put upon record our appreciation of the prudence and sound principle displayed by the Corporation in their treatment of the subject from first to last. They recognize that electric lighting is a luxury or convenience of the age which those citizens of Glasgow who can afford to pay for it have a right to have at their command. The Corporation have made the necessary arrangements to supply it as cheaply and reliably as it can be had anywhere in the kingdom. This is a duty they felt they owed the city; and they have discharged it. At the same time, the new departure is not expected to result in anything wonderful. It merely means one more addition, and not a very large one, to the Corporation departments; and it will be expected to stand or fall upon its own merits. So far as we can gather any information upon the point, there has been no such enthusiastic backing of the electric lighting scheme by anybody connected with the Corporation as we have seen elsewhere; and there will consequently be less temptation to bolster it up at all costs.

If any justification were needed in regard to the action of the Board of Trade in requiring electric lighting wires to be put snugly away underground, it might be furnished by two pictures of a portion of Broadway, New York City, recently published by the *Electrical Engineer*, and reproduced by *Industries*. One view shows the street as it appeared with the overhead wires, and the other the same thoroughfare with the wires removed. The former is a striking illustration of the extent of the nuisance which an inefficient local government permitted to be inflicted upon the long-suffering city; and it shows how much we have to be thankful for, in that the electricians were restrained from perpetrating the same kind of offence in the cities and towns of the United Kingdom. Broadway was literally darkened by innumerable badly-hung wires, not carried over the housetops, but strung from cross-bars on huge, misshapen, irregularly-placed posts stuck into the pavement more or less along the line of the curb. The roadway was crossed and re-crossed by bundles of these wires, among which the electric light conductors were distinguishable by being covered with a white insulating compound, which hung down in shreds in every direction. It is matter of history how at length the State Legislature passed a resolution that this condition of things was not to be endured, and ordered all wires to be put underground within a named period, which, notwithstanding the wailings of the electric lighting interest, was done. As our contemporary very truly remarks, however, burying the wires underground does not overcome every difficulty. Accidents will happen, even with the best-regulated currents. It seems hard to say of this matter that every additional wire, pipe, conduit, or cable put under the surface of a modern street is in itself an evil, and that the evil should be kept within the smallest possible bounds by rigidly refusing sanctuary to every superfluous addition to the numbers of such things already buried under the roadways; but there is no other safe way of looking at the subject.

We owe to our contemporary the *Electrician* the information that the constant explosions which occurred during 1887-89 in the New York electric wire subways led to the adoption of a pressure system of ventilation of these subterraneous cavities. The plan adopted is to provide by blowers and pipes an air pressure in the manholes and ducts greater than the gas pressure in the adjacent earth, and of sufficient volume to renew the air in the subways at least once an hour. The subways are kept as tight as possible; the air forced into them being compelled to make its exit through the walls of the manholes or ducts. There are now in operation twelve Roots blowers performing this function of subway ventilation at nine different stations. We thought of the New York subways in connection with the recent experience of The Gaslight and Coke Company in the City of London; but had heard nothing of them for some time. This explanation gives the reason why; and it now only remains to see how many more subway explosions it will take to render a similar system of ventilation compulsory on British electric light companies.

The Secretaryship of the Birmingham Corporation Water Department.—The Water Committee of the Birmingham Corporation resolved last Wednesday to appoint Mr. E. A. Lees, of Moseley, to the office of Secretary to the department, vacated by the resignation of Mr. T. Starkey. The salary attached to the post is £600 per annum; and there were altogether 171 candidates. Mr. Lees, it may be mentioned, is at present Assistant-Manager of the Bennett's Hill branch of the Metropolitan, Birmingham, and South Wales Banking Company. He was formerly Secretary to the Staffordshire Joint-Stock Bank; and, when it went into liquidation, he was appointed to the position of Liquidator of that concern.

MORE THOUGHTS CONCERNING WEALTH AND WAGES.

In the last two issues of the JOURNAL, we have presented certain views of the Duke of Argyll upon the important economical question of the source of wages, with the object of supplying our readers, whether of the class of employers or of that of the employed, with information suitable for use against the paralyzing doctrines of Fabians and Social Democrats. The validity of this information does not depend upon the source from which it is obtained. It should hardly be necessary to say as much; but misrepresentation is so cheap, and careless reading is so common, that it may perhaps be quite as well to remark here, once for all, that, in devoting so much attention to the utterances of the Duke of Argyll as an Economist, we do so simply because many of these observations strike us as being true to the facts of things and the experiences of every-day life. It is in this very point that the Trades Union leaders, who represent Fabianism in action, are so disappointing. They tell the world that they come from the people, and know what the people want; and yet when the ravings of any one of these men are examined critically, they turn out to be of a most imaginative cast, and derived from the writings of French and German dreamers. Of all men, these self-styled practical men are the most unpractical. Scarcely one of their most confidently pressed counsels will work; and none of their panaceas for curing the evils of the industrial body possesses the slightest value, simply because they have no relation to the facts of industrial life. These men get hold of a phrase, and by wrapping it up in the homely eloquence with which many of them are endowed, and driving it into their hearers' minds by dint of the sincerity and emotion which some of them have carried into the agitator's trade, they make the phrase go farther than it would have travelled without their aid. After all, however, the phrase is no more true because Will Thorne, the undoubted ex-stoker, has adopted it, than it was as Marx or some other muddle-headed Continental scribbler put it into his book. This is a point that does not seem to be generally understood. In the case of Mr. John Burns, M.P., it is impossible to say how much more fruitful of good his native force of character and gift of speech might have been if his stock of ideas upon industrial economics had not been so largely borrowed at the commencement from unpractical Continental theorists.

When the Duke of Argyll says, as we have seen, that all industrial enterprise depends in the last resort upon the security afforded to the individual conceiving mind, so that it can really count upon the constancy of certain agents, and can firmly trust to the certainty of enjoying some consequent results from the careful employment of its own faculties, and when he calls this "the true Wages Fund," we feel upon the sure ground of truth to the facts of industrial life. It is the individual human mind which, in reality, makes the wheels of industry go round. How many men owe their means of livelihood to Murdoch, Watt, Bessemer—to name only three individuals who have founded new industries within the century? And in what can we assume the springs and fountains of these men's enterprise to have lain, if not in "the most perfect freedom of movement in the individual mind, together with the greatest attainable certainty and security in the data of its calculations?" It was only by the removal of the restricting powers upon individual enterprise wielded by the Mediæval Trade Guilds that the creative work of such men as Watt was rendered possible. If the Hammermen of Glasgow, organized as a Trade Guild, could have had their way, Watt would never have made a steam-engine. Of course, they did not know what they wanted to do; but we can see plainly enough now that, but for the successful assertion in the case of Watt of the supreme right of the individual to work in his own ways, the greatest Wages Fund of all recorded time, which came into existence with steam power, would have been destroyed before its birth. And so the potent truth is made manifest, that everything which restrains the fruitful movement of the individual mind, and destroys its sense of security, strikes directly at the true Wages Fund of the whole world.

The Duke remarks that "what is above all things to be remembered is, that almost everything which does thus injuriously affect either mental freedom or the security of external conditions, works for the most part in the dark. It produces its disastrous effect silently, secretly, and very often entirely undetected and unperceived. For who can see or estimate the effects of doubt, or the operation of a general spirit of discouragement on the minds of men? The 'sensitiveness of capital' has become a recognized phrase for the expression of a natural, necessary, and universal fact. It means the sensitiveness of the individual men who are in the possession of capital; and this proverbial sensitiveness is the index and the measure of the effect produced by any causes which produce among them hesitation, or still more which justify alarm. If they see, or if they think they can even foresee, any new or arbitrary restraint on the perfect freedom of the markets in which they must buy, or in the markets in which they must sell again—still more, if even the shadow of a doubt is cast upon such fundamental conditions as the security of a contract, or as any failure in the government of society to respect all lawful rights, and to enforce all lawful obligations—then they simply abstain from acting even on the suggestions of enterprise which may actually occur to them. Still more do they abstain from that deliberate mental work which consists in that active and watchful search for opportunities which can only be encouraged under conditions of perfect freedom and stability. It is in the light of this consideration that the wage-earning classes must weigh with great care the indirect and unseen effects of those combinations among themselves which are intended to force up higher rates of remuneration for the share in work which they themselves contribute."

Workmen have a perfect right to combine for the purpose of strengthening themselves in making their bargains in the labour market. They have a clear and natural right to reckon on the indispensability of their services, and to make the most of it. "But they must reckon also on the alternative which is involved in this connection, and upon this alternative being the one which may, and which more or less extensively does, take effect. It is true that they are necessary to production. But it is also true that production is still more necessary to them. And in production they are not the primary, but only the secondary factors. They never, as a rule, can have the initiative. Those in whose minds the real initiative in all industrial enterprise lies may prefer the alternative of ceasing to conceive designs, or of ceasing to invest capital in designs which had perhaps already been conceived, of stopping invention, or of turning their thoughts and inventive and speculative faculties in some new direction." The new Political Economy, while it sternly represses the claim of manual labour to be the source of all wealth, has a message of hopefulness to deliver to those who live by the fruits of labour. The cruel Ricardian dogma that there is no way of securing good profits in trade or manufactures, except by keeping down wages to the lowest possible rate, has been proved to be a gross fallacy and delusion. It has been learnt in the school of experience that the highest paid labour is also the most efficient. Professor Marshall has justly spoken of this fact as being "more full of hope for the future of the human race than any other that is known to us." Economic science has conquered a vast territory when it has become seized of the truth that "everybody is profoundly affected for the better by the prosperity of everybody else. Nobody can get wealth except by serving in some way the wants of others."

It is impossible, within the limits available for the treatment of the subject in the JOURNAL, to discuss all the branches and developments of the reformed science of Political Economy which are dealt with, at greater or less length, by the Duke of Argyll in his book. Before leaving this work, however, we should like to state what the author holds to be true of the motive of industry which lies behind the payment of wages—the acquisition of wealth. This conception of wealth underlies all notions of what constitutes civilization. After many instructive attempts to obtain a satisfactory definition of wealth, the Duke concludes that it means "the possession, in comparative abundance, of things which are legitimate objects of human desire, and are desired by men who are able as well as anxious to acquire them at the cost of some sacrifice, or of some exertion." Every element in this compound expression is both susceptible and deserving of exhaustive examination, for which we must refer the curious to the original text. The next thing to be considered is, Where does wealth come from—what produces it? The old Economists used to lay it down, as a self-evident axiom of their science, that the three great sources of wealth are Land, Labour, and Capital. This statement is fiercely attacked by the Duke of Argyll, who says that the enumeration of this triune origin of wealth is "full of the most subtle confusions of thought, which are in the highest degree misleading and deceptive;" and he condemns it more especially as leaving out of account the immaterial and mental elements in the true conception of wealth, and in the true understanding of its sources. Moreover, none of these terms is truly elementary. The word "Land" does not mean the soil in general, but only such soil as is naturally productive or favourably situated in regard to the market—that is, an artificial land. The term "Labour" is exclusive of thought and of the mental qualities. "Capital," again, is essentially a consequence, and a product—chiefly of mind. Nor are these distinctions matters of mere academic interest. On the contrary, they force their urgent practical importance upon thinking men at every turn. "What can be worse in its practical effects," asks the Duke indignantly, "than that common distinction, or antithesis, which we see every day expressed or assumed in newspaper headings between 'Labour and Capital?' If it means anything at all, it means a fundamental distinction between muscular and mental labour. It means the exclusive appropriation of the word labour to the labour of the hands, and the elimination from it of all the energies of the brain. But this is the master-fallacy. . . . Nothing can be more certain than that capital is the embodiment and representative of the very highest kind of labour—namely, that in which the mental energy of forethought expresses itself in the savings and storeages of wealth already acquired. Nothing can be more certain than that mind is the *primum mobile*—the one great moving power—in the whole system of things in which we live." Labour without directing skill is profitless. The more skill, the greater the profit. "And if the wealth, or, in

other words, the earnings secured by labour of this high class, be handed over, as it were, to the care of those other mental faculties which go to make up the great gift of forethought, then those earnings become what is called 'capital'—differing in no essential element from the valuable and beautiful things of which it is the storeage or equivalent, and which, if they had not been stored, would have passed into immediate consumption. Every man who saves a sixpence is in his degree a capitalist; whilst at the same time every man who makes or adds to the storeages of wealth is in a very high degree a labourer." Taking account of the immaterial and usually neglected elements in the question, therefore, we are led to see that all the vast and various sources of wealth can be ranged under the three great categories of Mind, Matter, and Opportunity.

Space fails us to recount what the Duke of Argyll has to say about the unearned increment, and other bones of contention of modern Economists. Suffice it to say, in conclusion, that, while perhaps few who read the Duke's book from cover to cover will agree with every view taken by the author, he has done a worthy piece of public service in collecting in this volume so much that it is good for all classes of the community to bear in mind. We rejoice in being able to put in circulation, in the form of small change, some of the sterling matter here treasured up.

Mr. J. Hammond, Manager of the Eastbourne Gas Company's works, has been presented with a handsome gold watch by Mr. H. E. Jones, M.Inst.C.E., the Company's Consulting Engineer. Accompanying the gift was a letter in which the donor acknowledges in very high terms the assistance rendered to him by Mr. Hammond. It may be mentioned that this gentleman has devised a scheme for a harbour at Langney Point, Eastbourne, the construction of which would doubtless prove a source of considerable revenue to the town, by the facilities it would afford for landing coal, timber, stone, and other material. As the annual consumption of coal at the gas-works, which are rather less than three-quarters of a mile from the spot proposed, is about 40,000 tons, the economy resulting from their delivery at Langney rather than *viâ* Newhaven should commend the scheme to the attention of the Directors of the Company.

Incandescent Lights.—The chemical composition of the mantle in the new Auer incandescent lights has lately been discussed in the *Journal für Gasbeleuchtung*. The substance deposited on the cotton web consists of the oxides of metals of the cerium and zirconium groups, which exist in various minerals, for the most part in combination with silicic acid. The oxides are extracted from the minerals, and dissolved in nitric acid. This solution forms the bath in which the cotton web is dipped, and impregnates the latter so thoroughly that, on drying and burning, a finely-meshed mantle of the oxides remains. It is necessary that the oxides employed in the manufacture should be free from iron, as that metal exercises a marked deleterious influence on the radiating power. Few experiments have been made to test the durability of mantles made from different oxides, but those of complex composition appear to last best. M'Kean has demonstrated that thorium oxide develops the highest illuminating power from the gas, while oxide of lanthanum ranks next; followed in order by the oxides of yttrium, zirconium, and cerium. A mixture of two-thirds oxide of thorium and one-third oxide of yttrium is recommended for obtaining the highest lighting efficiency. He has also shown that the tint of the light is altered by the constitution of the mantle. The oxides of lanthanum, thorium, and zirconium all give a white light; the oxides of cerium, didymium, and niobium, even in small amount, give a yellow tint to the light; while cerium oxide in large proportion gives a red light, and oxide of erbium a green one.

Cheap Gas-Making Processes in America.—Gas engineers may possibly, says the *Engineer*, have an opportunity for business with the United States; for the latest advices show that manufacturers in several parts of the States are more eagerly than ever before looking out for cheap processes for producing artificial coal gas. This course has been rendered necessary by an increase in the rate at which many of the natural-gas wells are failing. The situation has indeed in some portions of the States become almost alarming; and some of the chief American works engaged in various industries are being, so to speak, thrown on their beam-ends through supplies of natural gas for heating purposes being cut off by the authorities of their localities, who desire, before it is too late, to husband the failing resources of the springs for the domestic lighting of the communities under their care. The latest instance of this sort comes from the city of Findlay, Ohio. In that district some of the largest works of America are engaged in making glass for window-panes, for bottles, and also for various other purposes. They have hitherto been dependent upon the natural-gas wells; but these are failing, and the supply for manufacturing purposes to the various works and furnaces has been cut off. These firms are appealing to gas engineers for assistance; for the question of machinery and plant for the manufacture of cheap fuel gas is with them just now a matter of life or death. Upon it depends whether they will be able to compete with the glass-works at Pittsburgh, where coal is abundant and cheap, or with those in portions of Indiana which have still a supply of gas.

NOTES.

Mr. Bryan Donkin on Refuse Fuel.

Mr. Bryan Donkin, junr., has read before the North of England Institute of Mining and Mechanical Engineers, a paper upon the generation of steam by forced blast, with special reference to the Perret system of burning dust and waste fuels. The author remarks upon the existence of a demand for improved means of getting rid of all kinds of refuse that can only be described as relatively combustible; and suggests that in the Perret furnace, ash-bin refuse and other dusty and poor fuel may be burnt economically for the production of steam. In this way, municipal authorities might obtain power which could be utilized in generating electricity for lighting purposes. At Warrington, for example, Mr. Longden, the Borough Engineer, has several steam-boilers with Perret furnaces at work in conjunction with the Manlove and Alliott destructor; and the combination is reported to work perfectly. No nuisance is produced, although house refuse is burnt without screening; and the clinker formed amounts to one-sixth of the total weight of the fuel. This clinker is used as hard core for roadmaking, &c. The steam is used in connection with a system for concentrating sewage, and for driving engines. At Shrewsbury Gas-Works, a Perret furnace burns house refuse occasionally; and it is suggested that, with the addition of 10 or 15 per cent. of coke dust or ashes, this class of rubbish could in many cases be burnt with very economical results. The paper has been separately printed, with illustrations.

Mr. Shelford Bidwell on Economical Light Generation.

Mr. Shelford Bidwell, F.R.S., lecturing at the London Institution on Electricity and Heat, made some critical observations upon the problem of obtaining light with less expenditure of heat energy than has hitherto been necessary for the production of luminous effects. He showed that there are two directions in which we may hope for improvement in this respect. On the one hand, it would be vastly more economical if the heat of burning coal could be converted directly into light, without having to submit to the wasteful exchange unavoidable with the use of the intermediary steam-engine; and, on the other, it might be possible to do something along the lines of Mr. Tesla's experiments, and aim at obtaining "light without heat." It is Mr. Bidwell's opinion, moreover, that no further labour or time should be spent upon attempts to improve the efficiency of the thermopile, for the reason that it has been demonstrated that at least 299 parts in 300 of the heat expended in these appliances is wasted. Mr. Bidwell had not, however, any fresh suggestions of his own to offer on this subject.

A Coke Pushing Machine.

In connection with the development of machinery for drawing gas-retorts, it may be of interest to note that the somewhat similar problem of emptying Semet-Solvay coke ovens has been attacked by American mechanical engineers by the converse method of pushing out the charge. A set of such machines has been made by Messrs. M'Lanahan and Stone, of Hollidaysburg, Pennsylvania, for the Solvay Process Company, of Syracuse, New York. The main frame of the pusher consists of steel beams, spanning a wide rail track, and provided with a truck at each end carrying suitable wheels. The machine is traversed along the rails by a self-contained steam-engine. The pusher proper consists of a heavy beam placed centrally between the two beams of the frame, and running upon grooved rollers. Upon the forward end of the beam is placed the head, which enters the oven. The top side of the beam carries a rack, into which a pinion engages, and thus gives a reciprocatory motion. The pinion appears to be heavily geared up, as would obviously be necessary, if the whole charge is to be pushed out at one stroke. Suitable means are provided for enabling the thrust of the machine to be taken up by friction-rollers bearing against a rail firmly anchored to the ground. The whole machine, as illustrated in *Iron Age*, looks very strong and simple; and it is reported to quickly and easily perform the work required of it.

Death of Mr. E. Hoar.—The death is announced, at the age of 74, of Mr. Edward Hoar, who was for many years Clerk to the Maidstone Gas Company. The deceased was actively associated with most of the public improvements of the borough.

Anthracite Coal Bricks.—A method has lately been introduced of utilizing the waste dust of anthracite in the manufacture of block fuel; the grains of dust being made to cohere by means of a special cementing compound and by great pressure. This compound is not pitch, but a dry powder, composed of two natural substances which are stated to be cheap and abundant, and have no deleterious effect on the flues or plates of boilers. The process of manufacture of these coal bricks is as follows: The dust is mixed with the binding material in the proportion of 96 per cent. of the former to 4 per cent. of the latter. The compound is fed into a mixer, where it meets a jet of steam; a stiff paste being formed, which is delivered successively into a series of moulds under a pressure of 25 cwt. The bricks are found to make good fuel, and to possess high efficiency for steam-raising purposes. Their manufacture is not restricted to anthracite; ordinary coal dust, as well as coke, being suitable.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Last Saturday afternoon, the Twenty-third Annual Meeting of this Institution was held at the Palatine Hotel, Manchester. Mr. CHARLES ARMITAGE, the President, occupied the chair.

THE MINUTES.

The HON. SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the previous meeting; and they were confirmed.

NEW MEMBERS.

Mr. Alfred West, of Rastrick, was proposed as a member of the Institution by Mr. R. PORTER (Elland), seconded by Mr. A. GRAHAM (Hebden Bridge). Mr. James H. Whitell (Haworth) was nominated by Mr. GRAHAM, and seconded by Mr. PORTER. Both gentlemen were unanimously elected.

REPORT OF THE COMMITTEE.

The HON. SECRETARY read the annual report of the Committee, as follows:—

The Committee, on presenting their report, are pleased to be able to congratulate the members on the continued usefulness and prosperity of the Institution.

There have been ten new members elected during the past year; three members have resigned; three cease membership under Rule I.; and one member (Mr. P. Hancock) has died during the year. This leaves ninety members on the roll of the Institution.

The annual meeting was held at the Grand Hotel, Manchester, on Saturday, Feb. 27, and was well attended. Owing to the unavoidable absence of Mr. T. O. Paterson, through an accident, Mr. W. W. Hutchinson, the immediate Past-President, was voted to the chair. After the usual routine business, Mr. C. Armitage was installed in the presidential chair, when he gave a very instructive and valuable address. The Secretary then read a very interesting paper, on "Management," which had been prepared by Mr. T. Newbigging, who was unable to be present.

The May meeting was held at Skipton, and was exceptionally well attended. A visit was paid to Bolton Abbey and Woods. The day being very fine, the visit was thoroughly enjoyed by all present.

The 91rst quarterly meeting was held at Rochdale, on Saturday, Aug. 27. There was a good attendance of members. Amongst the visitors were Dr. Thorne, of London, Mr. S. Stormonth, of Coleraine, President of the North of Ireland Association of Gas Managers, and Mr. Thos. Stenhouse, F.I.C., F.C.S., Borough Analyst of Rochdale. Mr. T. Banbury Bali, on his own behalf and in the name of the Chairman of the Gas Committee, gave the members a hearty welcome to Rochdale. Mr. Stenhouse then contributed a valuable paper entitled "The Behaviour of Oxygen when Air is Used in the Purification of Coal Gas;" and at the close he gave a number of interesting experiments, after which a good discussion ensued. Subsequently, a number of the members and visitors were conducted through the works, and inspected the Coze system of inclined retorts and Brin's oxygen plant. Unfortunately, the members were not favoured with fine weather. Consequently, only a few paid a visit to Blackstone Edge and the old Roman road, which proved to be very interesting to those who were brave enough to undertake the journey in such unpropitious weather.

The November meeting was held at the Grand Hotel, Manchester, on Saturday, Nov. 28, when there was a large attendance. Mr. W. R. Chester, of Nottingham, was unanimously elected President for the ensuing year. Mr. Harrison Veevers read an interesting paper on "The Use of Oxygen in the Purification of Coal Gas," which led to a very animated and highly interesting discussion. Mr. W. R. Chester contributed a useful paper entitled "An Account of a Recent Explosion in a Tar-Well." A number of the members afterwards took part in the discussion; and they little thought that the reading of the paper was to be so shortly followed by a similar explosion at the Bradford Corporation Gas-Works.

The Committee are particularly desirous of calling the attention of members to the papers submitted during the past year on the use of oxygen in the purification of coal gas, which have been so highly interesting, and caused such considerable discussion and correspondence in the gas journals. The Committee venture to say that these papers alone are sufficient evidence to prove the good work that is being done in disseminating valuable information; and they trust that the subject will not be allowed to be dropped, but continued during the coming year. They now invite members to contribute papers on this very interesting subject, which is so important to the gas industry.

The retiring members of the Committee are Messrs. W. Foster and E. Lord.

(Signed) CH. ARMITAGE, President.
March 4, 1893. SAML. S. MELLOR, Secretary.

Mr. ISAAC CARR (Widnes) moved the adoption of the report, and remarked that it was a very satisfactory record of the work of the past year. As to the small debit balance shown by the accounts, he thought that, with a membership of ninety, there ought to be no difficulty in paying their way.

Mr. C. E. JONES (Chesterfield) seconded the proposition.

Mr. W. W. HUTCHINSON (Barnsley), in supporting it, pointed out that the expenses of general meetings were £12 6s. 7d.; so that members received a direct return for their subscriptions. As a former Hon. Secretary, he knew that members would very much add to the comfort of the secretarial duties if they would not forget to remit their subscriptions.

The resolution was carried.

ELECTION OF OFFICERS.

Mr. HUTCHINSON proposed the election of Mr. James Braddock, of Radcliffe, as Senior Vice-President for the forthcoming year. Mr. Braddock had, he said, the esteem of all the members, and was eminently fitted for the position to which they proposed to elect him. He would do credit to the Institution, for he was a gentleman whose ability was only equalled by his modesty.

Mr. A. SHIRES (Biddulph) seconded the proposition. He remarked that Mr. Braddock had been a member of the Committee, and discharged the duties of that office, and those of the secretaryship, very satisfactorily; and so he was eminently fitted for the position of Senior Vice-President.

The resolution was carried by acclamation.

Mr. BRADDOCK said he was deeply sensible of the honour which the members had conferred upon him. Though he feared he could not be of such use as his predecessors, still his best services should be put forth in the interests of the Institution, and to aid the President in his year of office.

Mr. JONES moved that Mr. G. Smedley, of Buxton, be elected Junior Vice-President. He felt sure that everyone would agree with him that Mr. Smedley had been too long in the background, and that modesty had kept him in the shade when he ought to have been in the "fierce light" which beats upon the presidential chair. He trusted this honour would lead in due course to Mr. Smedley occupying the chair—a position in which he would do honour and credit to the Institution.

Mr. E. LORD (Whitworth) seconded the proposition, which was carried.

Mr. SMEDLEY, in acknowledging the resolution, said he accepted the office with fear and trembling. He had seen younger men than himself fill the chair with credit; and though he had been in the profession perhaps more years than almost any of his fellow-members, he had always been connected with small works, and had not perhaps gained that experience which some younger men had. This feeling had made him hesitate to accept office; but, having put his hand to the plough, he should not look back.

The PRESIDENT proposed the re-election of Mr. T. Newbigging as Treasurer—an office which he had filled very satisfactorily for a number of years.

Mr. BRADDOCK seconded this nomination. Mr. Newbigging, he said, was a gentleman with whom they were all pleased and proud to be associated. His services at the Committee meetings were very valuable; and in that capacity his re-election was desirable.

The resolution was carried.

Mr. W. DUFF (Morecambe) moved the re-election of Mr. S. S. Mellor as Honorary Secretary. Until he became a member of the Committee, Mr. Duff said, he had no idea of the great amount of work done by the Secretary, or of the admirable manner in which this work was carried on. It was greatly to the benefit of the Institution that it had so able a Secretary.

Mr. JONES seconded the motion, and said there was no doubt that, to properly appreciate the position and work of the Secretary, it was necessary for one to be behind the scenes to a large extent. Ordinary members knew very little of the arduous nature of the duties of the office. The Institution had derived great advantage from having able Presidents, and able, conscientious, and industrious Secretaries; and amongst such Secretaries Mr. Mellor took high rank.

The proposition was adopted with applause.

Mr. MELLOR acknowledged the compliment implied in his re-election, and said that, though he feared he did not deserve all the kind words said of him, he had tried to do his best, and should continue to do the best he could for the Institution.

Mr. A. GRAHAM (Hebden Bridge) proposed, and Mr. W. WHATMOUGH (Heywood) seconded the election of Mr. G. Niven (Cleckheaton) as a member of the Committee, which was carried.

Mr. HUTCHINSON then moved the election of Mr. T. L. Sheppard, of Farnworth, as a member of the Committee; and this, having been seconded by Mr. I. CARR, was carried.

Mr. T. DUXBURY (Darwen) proposed, and Mr. J. PARKINSON (Brighouse) seconded, the re-election of Mr. W. Smith, of Hyde, and Mr. J. Mackenzie, of Wilmslow, as Auditors; coupling with it a vote of thanks to these gentlemen.

The proposition was carried.

Mr. I. CARR moved a vote of thanks to the Committee for their past services. They had had, he said, a very complete and satisfactory report. The Institution continued very prosperous; and everybody would agree that the Committee were deserving of their best thanks.

Mr. J. CHADWICK (Oldham) seconded the proposition, and it was carried.

THE RETIRING PRESIDENT.

Mr. ARMITAGE then said: The time has now arrived when I should vacate this chair, and introduce to you Mr. Chester, of Nottingham, whom you have chosen to preside over your deliberations during the coming year. I can assure you that it is to me a great pleasure to introduce to you the President-Elect; and I have every confidence that he will fill the position with credit to the Institution and to the profession. Before leaving the chair, however, I would just remark how pleased I have been to occupy the onerous position of President, and further to thank you heartily for the support you have given me during my year of office. The meetings during the past year

have been well attended; the subjects brought before you (especially that of purification) have been very interesting, and more especially in consequence of the correspondence which followed on the elimination of sulphur compounds other than hydrogen sulphide. The point in dispute is whether the product of calcium hydrate and hydrogen sulphide is capable of combining with carbon disulphide without the material being exposed to the air. One correspondent is of opinion that it is necessary that the product should be exposed to the air, or a small percentage of air should be admitted to the purifying-box. This is the general opinion of other engineers. Another correspondent entertains quite a different opinion, and he quotes Mr. V. H. Veley, who contributed a paper on the subject to the Chemical Society in 1885 (Vol. 47, page 490), in which it is distinctly stated that dry calcium sulphide does not, but moist calcium sulphide does, absorb carbon disulphide, and that the conversion of calcium sulphide or calcium hydrosulphide into calcium-hydroxy-hydrosulphide precedes the absorption of any appreciable quantity of carbon disulphide. Also that calcium-hydroxy-hydrosulphide suspended in water absorbs carbon disulphide. Thus the last-named substance is the absorbent formed either from calcium sulphide or calcium hydrosulphide. These changes of the sulphides are shown to be effected by the addition of water only, in accordance with the following equations:—

(1) $CaS + OH_2 = Ca\,(SH)\,OH$

(2) $Ca\,(SH)_2 + OH_2 = Ca\,(SH)\,OH + SH_2$

(3) $Ca\,(SH)\,OH + CS_2 + OH_2 = 2\,Ca\,(OH)_2 + CaCS_3 + 2\,SH_2$

In Mr. Veley's communication to the JOURNAL OF GAS LIGHTING (Jan. 3, 1893, p. 22), he states that calcium hydrosulphide is inert towards carbon disulphide; but if air or hydrogen with carbon disulphide (an artificial mixture made to resemble impure gas) be passed through a solution of calcium hydrosulphide, a considerable quantity of hydrogen sulphide is given off, and simultaneously with the separation of the calcium-hydroxy-hydrosulphide the absorption of the carbon disulphide commenced, and eventually red crystals familiar to gas engineers were formed. These contained not only the hydrate, but also the sulpho-carbonate. This, I submit, is another digression in which hydrogen is shown to be the active agent. Now, if hydrogen has the power of bringing about these changes, there should be no difficulty in absorbing sulphur compounds without the addition of oxygen, as coal gas contains about 40 per cent. by volume of free hydrogen. It would, however, be very interesting to know the chemical actions that absolutely do occur; and I hope the day is not far distant when we shall be in full possession of the information, in order that we may be enabled to offer to the public coal gas in which the most fastidious cannot find any cause whatever to complain. However, our thanks are due to those gentlemen who have probed the subject to its present position; and I trust that they may continue their researches.

THANKS TO THE EX-PRESIDENT.

The PRESIDENT-ELECT (Mr. W. R. Chester) said his first duty was to propose a vote of thanks to the retiring President. He did this regretfully, because he felt that they were parting with a gentleman who had done his work exceedingly well in the past year, and had gained the popularity and admiration of the members of the Institution. Mr. Armitage was a painstaking chemist and a good engineer; and he had certainly added lustre to the presidential chair of the Institution.

Mr. PARKINSON seconded the resolution. He said Mr. Armitage had attended to the work of the Committee remarkably well, and they had felt great pleasure under his presidency.

The resolution was adopted.

Mr. ARMITAGE briefly replied, and said he had endeavoured to serve the Institution and was very pleased to have their approval.

Mr. CHESTER then read the following

INAUGURAL ADDRESS.

Gentlemen,—In taking the presidential chair of this important Institution, it is my pleasing duty to congratulate the members on the continued prosperity of the Association, and at the same time to chronicle our satisfaction at the increasing prosperity of the business in which we are all so profoundly interested. The Association which grew out of an informal meeting of gas engineers called together some twenty-three years ago, to bid God-speed to a respected colleague then departing for South America, now ranks in point of numbers, with one exception—that of the North British Association—as the most influential of all the District Associations. But if we take as a measure of importance the volume of business controlled by its members, then it stands second to none in the power and influence it wields. Its usefulness as an educational medium has during its existence been demonstrated over and over again, by the excellent papers which have, from time to time, been brought under its notice, and by the no less excellent discussions which these papers have developed. Whether the author of, or the listener to, a paper is the larger recipient of benefit from its consideration, is a moot point; but whatever benefit is derived, from an intellectual point of view, by the members of the Institution, the fruits of the interchange of experiences is reaped by the undertakings under the control of its members.

New discoveries, improved methods, new ideas, better systems of working, more economical results, increased output, diminished leakage, decreased capital expenditure to accomplish results—all, in turn, receive consideration. The experience of the individual is placed at the disposal of the Institution in the most unreserved manner; thus effecting immense saving in time and money, and enabling the gas undertaking to appropriate and adopt an improvement as soon as it is discovered and demonstrated. Since the foundation of The Gas Institute and its numerous offsprings in all parts of the country, improvements in gas manufacture have made more rapid progress during the past twenty years than in all the preceding sixty years since its first introduction—these improvements all tending in the direction of economy, and being the means of placing within the reach of the gas-consuming public a larger volume of light, with increased purity, at a reduced cost. The good practical work done by these Institutions, and the immediate benefits to be derived from their conferences, entitle them to the warmest encouragement, sympathy, and support of Gas Committees and Directors of Gas Companies at large; and I should like to see their efforts recognized and appreciated in a larger degree than has been customary in the past.

That something is being done in this direction, I can point with pleasure to the ready response made by a number of influential Gas Companies and Local Authorities to the appeal for funds made by The Gas Institute last year, to help them to carry on the work of investigation and research. So intimately are the interests of the purveyors of gas, and, indeed, the public at large, bound up with the welfare and success of these Institutions, that the money voted in promoting their work will be found to be a most profitable investment. It lies with the individual member to justify the higher appreciation in which these Institutions are beginning to be held, and to take care that the work done is made known in the proper quarter, and then leave it to find its due appreciation.

During the period which has elapsed since the Paris Exhibition of 1881—when the practicability of illuminating by electricity was demonstrated on a large scale, and the investing public were first dazzled by its display—every year has brought us some new and startling discovery, by which gas as a domestic illuminant was to be "snuffed out." In the ten or eleven years which have elapsed, hundreds of electric lighting companies have been registered, with millions of capital. In Great Britain alone, electric lighting companies have been registered with a total nominal capital of £9,700,000, of which £3,820,000 have been called up; and this sum is exclusive of the amount expended by municipalities and local authorities, of which at present we have no return.

How far this capital has been wisely expended, may be judged by the limited number of companies able to show any commercial success. Where success has been attained, it will be found that the company is in the happy possession of some compact and rich district of supply, in which cost is only a secondary consideration to the resident. If we take the cost at which electricity can be profitably supplied at 6d. per Board of Trade unit of 1000 watts, and compare this figure with that of 18-candle gas at 2s. 6d. per 1000 cubic feet, we get a comparative cost, light for light, of rather more than two to one in favour of gas. So long as these proportions are maintained (and there does not appear to be much prospect of them bearing a different relationship to each other), it will be impossible to supersede gas, or diminish its popularity as a domestic illuminant.

While every new electrical invention has been heralded in by the press with a great flourish of trumpets, and new companies for its supply have sprung up with marvellous rapidity on every side, the consumption of gas has steadily increased, and the prosperity of the undertakings supplying it have been maintained. The total capital invested in authorized gas undertakings in 1882 was £50,261,118; and in 1892 it was £63,620,461—showing an increase of 26·6 per cent. in the ten years. The consumption of gas, which stood at 66,614 million cubic feet in 1882, increased to 99,870 millions in 1892; or a total increase of 50 per cent. for the same period. This steady rate of increase is the more satisfactory when it is borne in mind that it has been won in competition with both the electric light and that obtained from the cheap mineral oils which have been placed on the markets in such abundant quantities during the past ten years.

In commencing this second decade of the electric lighting era, we have less cause for anxiety than existed ten years ago. We are now in a position to more correctly estimate its cost of production, to gauge its possibilities, and to pretty accurately determine its usefulness. The mind of the public, as well as the timid shareholder, has now become more settled; and it is generally recognized that the two systems have their respective spheres of usefulness, and can be run in "double harness" almost without competition, and with mutual benefit to themselves and the public at large. It may, I think, be safely anticipated that in the next decade the prosperity of gas undertakings will not be diminished; the stimulating influence of a friendly competition will more rapidly develop the latent resources of the gas manufacturer; production will be cheapened; and consumption will increase as a natural consequence. If we look back over the period of the last seventy years, commencing in 1824, we shall find an almost unbroken record

of diminution in the selling price of gas. This represents not a corresponding decrease in the cost of the raw material; for, while the latter has diminished 56 per cent., the selling price of gas has gone down 85 per cent., and this decrease has been coincident with a rise of wages of between 70 and 80 per cent. In London the following are the figures:—

Year.	Selling Price of Gas per 1000 Cubic Feet.	Cost of Coal per Ton.	Daily Wages of Stokers.
	s. d.	s. d.	s. d.
1824 . . .	16 0	29 3	—
1833 . . .	11 8	18 3	3 8½
1843 . . .	8 0	20 2	4 0
1853 . . .	4 8	21 2	4 0
1863 . . .	4 8	18 2	4 3½
1873 . . .	3 6	31 7	5 0
1883 . . .	2 10	12 10	5 5
1893 . . .	2 6	12 9	6 7

The steady decline in the selling price of gas during the past seventy years, which is one of the best indications of a successful and prosperous business career, has in the main been brought about by the inventive resources of the engineer and the chemist, whose combined skill has succeeded in extracting the maximum efficiency from the coal, and at the same time reduced loss by leakage and waste to a minimum. By their efforts it has been possible to maintain the prosperity of the undertaking, to give substantial reductions in price to the consumer, and to improve the condition of the labourer, both financially and by giving him increased leisure. If it has been possible to do so much in the past, is there still a margin for further advancement in the direction of cheap gas in the future? I think the signs are most hopeful; and it is not a difficult matter to indicate some at least of the influences contributing towards this result.

The most imminent is a probable reduction in the price of the raw material, which has apparently been carried beyond its legitimate market value, and which has already commenced to recede. I do not consider it desirable, in the interests of the gas maker or those of the general public, that the price of coal should decline to the low ebb of 1888, when in the majority of cases it could not be raised for the money. But between that and present prices there is so large a margin that a reduction may reasonably be expected when contracts are next made. A reduction or rise in the price of the raw material, however, is merely an incident of the market, and one for which no credit or blame can be taken or accepted by the engineer.

We may look to the introduction of the regenerator furnace, and its general adoption in gas-works, for a more satisfactory and permanent means of reducing the cost of production. The principle of gaseous firing has been under discussion for the last fifteen years; and though its theory is now well understood, and admittedly correct, yet its practical application has made but slow progress. The failures met with in its early application were largely due to a want of knowledge of the fire-resisting capabilities of the material which it had been customary to use in the ordinary coke-fired setting, and also to an insufficient knowledge of the intensity of the heat which could be generated from the combustion of producer gases. The early retort-settings on the regenerator principle were constructed in the same manner, and with the same kind of material, as the old coke-fired setting, with the result that the interiors were soon gutted by the intensity of the heat, or the material was so softened that the retorts tumbled to pieces in the most startling manner. The material used was physically unfitted to withstand the intensity of the heat; but at first the requirements were so little understood, even by the most scientific of engineers, that in the light of our present knowledge the most foolish things were sometimes done.

I remember a system of regenerator settings being devised and erected under the supervision of the greatest authority in the country on gaseous firing of that time, where the lower portion of the regenerator flues were constructed of the common red building-bricks, on the expectation that the waste gases ere they reached this point would have lost so much of their heat to the secondary air, as to be quite harmless when brought in contact with the house-brick. The heats in the settings were splendid; but as they gradually descended to the main flue, and began to act on the common brickwork, we speedily had indications of the catastrophe which was about to ensue. The common bricks melted, and began to run off in lava-like streams; and the whole superstructure collapsed in slightly under three weeks from the time of lighting up.

The difficulty encountered in finding suitable fire-material to withstand the intense heats of the combustion chambers, has driven some engineers to "seek salvation" in a sort of half-way house, and others to fall back upon gaseous firing in its elementary form, lest greater evils befall them. In either case they sacrifice from one-half to one-third of the total advantages to be derived from a complete system of gaseous firing combined with regeneration.

The wastefulness of the direct coke-fired furnace is due principally to two causes—first, to the amount of unconsumed carbon which is lost in the frequent clinkering and disturbance of the fire; and, secondly, to the large volumes of cold air admitted during the process of clinkering and frequent feeding of the fire. In the gaseous-fired furnace, which requires feeding much less often, the deleterious effects of the cold air are reduced to a minimum, and almost every particle of combustible matter in the coke is utilized. In this way, an economy in fuel is effected to the extent of about 6 cwt. per setting per 24 hours, which represents roughly 8,000,000 units of heat. Now, if we stop at this "half-way house," we have accomplished a considerable economy in fuel and labour; but we have by no means carried the economy to its ultimate limit. The theoretical quantity of air required for the secondary combustion of the producer gases amounts to an enormous volume in the 24 hours—equivalent to about 270,000 cubic feet; and if we take this figure, and allow nothing for an excess of air which is a practical necessity, we shall require rather more than 8,000,000 units of heat to raise it to a temperature of 1800° Fahr., which is a little under the temperature at which the producer gases enter the combustion chamber. In other words, if we admit this volume of cold air to the combustion chamber, we must consume so much additional coke as will raise it to this temperature, in order to maintain the heat of the setting.

The temperature of the waste gases leaving the setting, after having completed their work, is about 1900° Fahr.; and in the direct coke-fired furnace and the simple producer this heat passes to the chimney and is dissipated. But where the principle of regeneration is in operation, a large portion of this escaping heat is utilized in raising the temperature of the secondary air to that of the producer gases, and thus enables the temperature of the setting to be maintained with a diminished fuel consumption equivalent to 6 or 7 cwt. of coke per setting.

The advantages of the regenerator over the simple generator furnace are clearly demonstrated; and it only remains to select and adopt a suitable fire-brick to withstand the high temperature of the combustion chamber, to enable everyone to reap the full benefit of the regenerator principle. During a long experience, I have experimented with every kind of fire-brick known to me; and I am only aware of one which possesses in a high degree all the characteristics necessary in a brick which can be successfully used for this purpose. Providing this special fire-brick is used in and around the combustion chamber, the rest of the setting may be constructed of the ordinary Stourbridge or other material which it is customary to use; and the regenerator setting then becomes as durable as the most exacting person can wish.

If we compare the cost of a regenerator and an ordinary setting (apart from the first outlay in providing the producer and regenerator flues of the former), there is no material difference; and the cost of periodic renewals is about the same per mouthpiece for similar sized retorts. But as the ordinary setting requires two expensive repairs during a lifetime, and lasts only half as long as a well-constructed regenerator setting, the cost for wear and tear stands at about three to one in favour of the regenerator.

It may not be uninteresting to give here the results of a prolonged trial of the two systems working side by side, showing the wear and tear charges per ton of coal carbonized—

	Regenerator Setting.	Ordinary Setting.
	£ s. d.	£ s. d.
Original cost per mouthpiece . .	5 0 0	5 0 0
Repairs and re-furnacing . . .	nil	1 0 0
	5 0 0	6 0 0
Coal carbonized per mouthpiece during life	625 tons	231½ tons
Wear and tear charges per ton of coal carbonized	1·92d.	6·22d.

In addition to the reduction of the wear and tear charges of 4d. per ton, there is a further reduction in the cost for labour of 3d. per ton, and a saving in fuel equivalent to 1s. 5d. per ton, which together effect a combined reduction in the cost of production amounting to 2s. per ton of coal carbonized.

The efficiency of a retort must be measured by its first cost and the amount of work which can be got out of it in a lifetime. If we take the cost of a regenerator setting complete—with new walls, arches, main flue, furnace, regenerators, and settings, together with new mouthpieces, ascension-pipes, hydraulic mains, relief mains, weir valves, excavation below the floor line, new floor, and everything fitted up in the best style—at £40 per mouthpiece, and the average work done by such a setting at 625 tons, the economy effected during the first life will recoup the whole cost, and leave a margin of more than 50 per cent. profit. After the first outlay has been incurred, the cost for renewals will not exceed £5 or £6 per mouthpiece; and the net profit on the second life of the retorts will be £50 to £55 per mouthpiece more than is possible with the old system of retort-firing.

Great as are the advantages of the new over the old system of heating retorts, the regenerator setting has not yet captured the whole of the larger gas-works, and has made but little progress in works of moderate size, only a few of the more enterprising of the smaller works having adopted the system. It may be confidently anticipated that the next ten years will see the system almost universally adopted, the effect of which will be a material reduction in the cost of production of coal gas.

The next most influential means of lowering the cost of production is the introduction of machinery for carbonizing. The field for this is not quite so extensive as that for the regenerator furnace, because, to employ a machine with the best results,

the magnitude of the works must be such as to give it full employment. When it can be used with full advantage, the economy effected ranges from 1s. 6d. to 2s. per ton of coal carbonized. The inventive resources of engineers have for many years (almost from the commencement of gas making) been turned in the direction of providing a machine to minimize the laborious work of the stoker, and many systems have been tried; but, owing to the complicated nature of the work to be done, few have ever got beyond the works in which the invention was incubated and the machine was first applied. With one notable exception, machine after machine has had to be abandoned; and there is but one system in which the practical advantages have been such as to secure it a wide adoption. There is still a large field of usefulness for the application of machinery, and the magnificent specimens which have lately been turned out by Messrs. West and Co., of this city (and which I had recently the privilege of seeing in operation at the South Metropolitan Gas Company's works in London), will do much to encourage a more universal adoption of this means of still further lowering the cost of production.

The application of the inclined retort as a means of minimizing cost is receiving considerable attention; and, as it can be utilized in small installations, it offers many attractive features to moderate-sized works. Whether it possesses any advantages over the horizontal retort and stoking machinery, I am scarcely in a position to judge, as I have had no personal experience in working it. It appears, however, to possess one considerable drawback, in being dependent on the natural force of gravitation to effect an even distribution of material in the retort. Providing every class of coal used in a gas-works were uniform in size and physical condition, the inclination of the retort could be made to suit the force of gravitation, and an even distribution might thus be effected. But as this is a practical impossibility, there will always be a considerable degree of uncertainty in the satisfactory working of the system. The mechanical stoker, being entirely under control, does this portion of its work with perfect certainty; and nothing is left to the uncertain and sometimes arbitrary action of a natural force.

Among the minor matters tending to economy in production which are likely to be effective in the present decade, are the application of machinery to the conveying of coal and coke to various parts of a gas-works. Several successful installations have already been applied—the most notable being the coal conveying and stacking machinery of the Oldham Corporation, and the coke-conveying scheme of the South Metropolitan Gas Company. Many other works are now contemplating advances in this direction; and we may expect to see the system much extended in the next ten years. In connection with this conveying system, considerable advantages are to be obtained from the erection of coke-hoppers for rapidly loading carts and railway trucks; and the erection of apparatus for breaking, sorting, and washing coke for smithing and domestic use. There is a large and profitable business to be done in broken coke; and I commend the cultivation of a trade in this direction to those members of the Institution who are accustomed to carbonize a high-class coke-producing coal.

Leaving now the directly productive portion of a gas-works plant which may be expected within the next ten years to effect considerable economies, I will briefly refer to two of the indirectly productive portions, which are likely to exert an important influence in the same direction.

There is no department of a gas undertaking in which more important advances have been made than in gasholder construction. The colossal holder just completed by Mr. Livesey for the South Metropolitan Gas Company is in itself a triumph of engineering skill, reducing at once the capital charges per 1000 cubic feet of storeage capacity to one-half the sum formerly considered a minimum figure, and to one-sixth of that which was customarily expended for storeage plant but a few years ago. The inventions of Mr. Gadd, for the abolition of the upper guide-framing of gasholders, and that of Mr. Pease, for guiding by wire rope, mark most important departures in gasholder construction, all tending to greater economy in the provision of storeage capacity, and consequent lowering of the price at which gas can be sold.

After having produced our gas cheaply, we may still further lessen the selling price by increasing the consumption, and the invention of the prepayment meter has placed within our reach an instrument which will greatly help in this direction. The average consumption of the prepayment meter will reach approximately 10,000 cubic feet per annum; and, therefore, the addition of each hundred meters will add to the consumption one million cubic feet per annum. Under the former system of supply, the cottage consumer was by no means a desirable customer. His account was small, and difficult to collect; and the bad debts were numerous. By the prepayment system of supply, bad debts are abolished; and the cottager becomes a desirable acquisition, and an eager consumer, likely to contribute in no small degree to increase the consumption of gas, and to give it a wider popularity as a domestic illuminant.

The fall in the prices of tar products has been the most conspicuous of the commercial aspects of gas undertakings for the past year. But depressed as the market is in these products, there is in my opinion no justification for the low current price at which tar in many instances is being sold to the distiller; and there is no wonder that the gas maker should have his attention turned towards the distillation of his own tar. In some instances, plant for this purpose is already being put down; and other gas-works are contemplating a step in the same direction. There is happily for the moment an improvement in the value of sulphate of ammonia, which will do something towards equalizing the loss on tar, in the case of those undertakings who work up their own liquor.

In conclusion, I must thank you, gentlemen, for the honour you have done me in electing me your President for the ensuing year. The distinction with which this presidential chair has been filled in past years by my predecessors, will ever be an incentive to me to do my best, while occupying it, to uphold and promote the interests of the Institution.

Mr. W. Carr (Stalybridge) moved that the thanks of the members be given to the President for his address, which he said had been worthy of their attention. There was much in it which would repay consideration. He had personally found it very interesting.

Mr. Shires seconded the proposition, and said the remarks as to regenerative firing would be very useful indeed.

Mr. Braddock added some complimentary remarks, and put the resolution to the vote.

It was carried by acclamation.

The President briefly acknowledged the compliment, and the formal proceedings ended.

The members afterwards had tea together.

THE USE OF ASPHALTE FOR RESERVOIR LININGS.

A Paper read by Mr. J. D. Schuyler before the American Society of Civil Engineers.

For a number of years past, experiments have been made in rather a small way, in various parts of California, in the use of asphalte for reservoir linings, particularly in the southern portion of the State, where the natural product abounds in a great variety of forms, from hard rock to liquid "mineral tar," so called, oozing from the ground in springs. The natural properties of asphalte seem to render it a very useful material from which to form a water-tight coating for reservoirs. It is insoluble in water, and neither acids nor alkalies dissolve it or affect its cohesion; hence it does not impart any taste or colour to water coming in contact with it. It is elastic, and will yield to a considerable settlement of the surface on which it lies without cracking or losing its integrity. It is easily repaired, and new material can be made to unite perfectly with the old, wherever a patch may be needed.

The writer has had occasion to examine a number of small reservoirs so lined; and in almost every case he found them in satisfactory condition, and generally impervious to water. One of these, which had been in use for four years at the town of San Buena Ventura, was an extreme example of the serviceability of asphalte. A circular reservoir, about 100 feet in diameter and 10 feet deep, had been excavated in light sandy and gravelly soil for perhaps one-third of its depth; the material excavated being used in the embankments. This was paved on the bottom and sides (sloping 1 to 1) with cobble stones laid in mud; the spaces between being partially filled with the mud mortar. When dry, this rude masonry was covered with a thin coat of liquid asphalte, poured on hot, and spread with brooms. The thickness of the sheet did not exceed $\frac{1}{8}$-inch, and in some places it was not more than $\frac{1}{16}$-inch thick. The reservoir was not covered. After being filled with water, one portion of the banks was said to have settled outward more than 2 feet, without breaking the integrity of the lining. The cost of the lining was very small; it has required few repairs, and it bids fair to render service indefinitely. Another reservoir examined by the writer was excavated in firm shale and soft sandstone, with nearly vertical sides, on which the hot asphalte was successfully applied. This was a small house-service supply reservoir; and it had been a year in use without repairs when examined.

Other instances of the use of asphalte to repair cracked and broken concrete linings of reservoirs were noted, in all cases with success. The writer subsequently constructed on his own premises a circular reservoir 64 feet in diameter and 7 feet deep, which he lined with asphalte $\frac{1}{2}$ inch thick. The side slopes are 1 to 1; and the first coat, consisting of a mixture of 15 per cent. of La Patera asphalte (which contained, by analysis, 66 per cent. of pure bitumen) and 85 per cent. of beach sand, after being heated to a temperature of 300° Fahr., was spread with hot rakes and consolidated by means of hot tampers and smoothing-irons. It was laid in sections 2 feet wide, half the height of the slopes. The edges should have been painted with pure liquid asphalte before the adjoining section was laid next to it; and doubtless it was owing to a neglect of this precaution that, after being in use for one year, small cracks appeared, outlining the joints where the various sections were laid. These cracks were all repaired, however, with half a barrel of asphalte, and the labour of one man for three days; and the reservoir is in perfect condition after two years, although exposed to the sun. The sheet of asphalte was tacked to the slope by means of strips of strap iron, 6 in. by $\frac{1}{8}$ in. by $\frac{1}{2}$ in., driven in at intervals of 18 inches in each direction. A second

coat, consisting of La Patera asphalte fluxed with about 10 per cent. of mineral tar—the heaviest of the natural oils of California—heated to a temperature of about 250° Fahr., was applied over the entire surface. It was poured on as thinly as possible, and ironed down with hot smoothing-irons. Its thickness averaged about ⅛ inch.

With this experience, and after a careful examination of the principal asphalte beds of Southern California, as well as of the sea walls laid in asphalte, the writer felt justified in recommending the use of California asphalte for the lining of two large distributing reservoirs constructed at the city of Denver (Col.), by the Citizens' Water Company. These reservoirs, known as the East and West Ashland Avenue reservoirs, lie side by side, and were excavated to their full depth of 32 feet on the upper or higher side; the material being used to form artificial embankments on the lower side, where the minimum depth of excavation below the natural surface was 6 feet. They are intended to be filled to a depth of 26 feet; and there was therefore on one side 20 feet in depth of water to be supported against a made bank. The whole of the west, and a portion of the east reservoir were excavated during the winter of 1890-91, when there was a good deal of frost in the ground; and although a 12-ton steam-roller was employed to consolidate the banks, a considerable settlement was anticipated, which would have been fatal to a concrete lining.

The dimensions of the west reservoir were as follows: Bottom, 341 feet by 256 feet; top, 350 feet by 420 feet; maximum depth, 32 feet; depth to roof-line, 29 feet; depth to high-water line, 26 feet; side slopes, 1·33 to 1; capacity, 22,000,000 gallons. East reservoir: Bottom, 152 by 494 feet; top, 236 by 580 feet; depth, slopes, and capacity, the same as the west reservoir. The material excavated consisted of 2 or 3 feet of sandy loam, 12 to 15 feet of hard clay impregnated with alkali, and 8 to 12 feet of shale—the "bed-rock," so-called, of the country. On the completion of the embankment, the slopes were sprinkled and rolled with a slope-roller weighing five tons, drawn up the slopes and lowered by an engine placed on a track along the top of the banks.

At the time the west reservoir was completed and ready for lining, it was found impossible to get the amount of California asphalte needed within the time available; and it was decided to use Trinidad asphalte, which could be obtained on the ground. A contract was made for the delivery of the materials at the reservoir, at a given rate per day. It had to be hauled in waggons about 2½ miles; and as the roads were muddy, and the weather cold, some of the asphalte chilled on the way, and had to be rejected. All that was put on was supposed to be of a temperature of 250° Fahr. and upwards. Beginning at the bottom, the slopes were laid in horizontal strips about 10 feet wide; the thickness averaging about 1¾ inches. It was spread with hot rakes, tamped as hard as possible with square tampers, kept hot and frequently changed, and ironed with heavy hot smoothing-irons. While the sheet was still warm, anchor spikes, cut from strap iron 1 in. by ⅛ in., 7 to 8 inches long, were driven through the asphalte into the bank, in rows 1 foot apart, about 12 inches from centres in the rows. Every other row was driven down flush with the surface; the alternate rows being allowed to project 1½ inches above the surface temporarily, to serve as a rest for strips of 2 in. by 4 in. lumber, placed loosely above them on the slope—thus forming steps for the men to ascend while working on the space above. When the finishing coat came to be applied, these projecting spikes were driven flush, and all painted over. The bottom thickness was about 1 inch. After spreading and tamping, it was rolled with a cold steam-roller, weighing five tons. The finishing coat of refined Trinidad asphalte, fluxed with residuum oil, was poured on hot, from buckets shaped like a coal-hod, and ironed over with hot smoothing-irons, heated to a cherry red. These irons had to be passed over the surface quickly, and produced a yellow smoke when first applied; but it was found that perfect cohesion with the first coat could not be secured, except by thorough ironing with very hot smoothers. When finished, the surface had a bright, glossy appearance, as though varnished.

The cost of this work was as follows:—

First Coat.

1304 tons 20 per cent. asphalte mastic, 80 per cent. sand, at $12	$15,648·00
15 tons 15 per cent. asphalte mastic, 85 per cent. sand, at $10	580·00
86·21 tons liquid asphalte fluxed with oil, at $40	3,448·40
Fuel for heating irons and for steam-roller	276·02
Lights	36·00
Tools	179·75
Peg irons—material, cutting and dipping in asphalte	650·00
Labour	1,921·50
Use of roller for six days	60·00
Total	$22,799·67

Area of surface covered, 152,580 square feet; cost per square foot, 14·94 cents.

The East Ashland Avenue reservoir was lined with California asphalte in July and August last. The material was furnished from the Santa Barbara County beds of the California Petroleum and Asphalte Company—the asphalte being from the La Patera mine, and the flux from Las Conchas mine; and it was prepared on the ground by the Blake Asphalte Company, of Denver.

In preparing the mastic for coating the reservoir, the proportion of the La Patera asphalte and Las Conchas flux used was about 78 per cent. of the former to 22 per cent. of the latter. It was boiled in open kettles for about 12 hours, at a temperature of 250° to 300° Fahr., and frequently stirred, to prevent burning or sticking to the bottom. The sediment that settled to the bottom of the kettle was removed with long-handled shovels, and used later on in another portion of the work for an asphalte concrete. For the first coat, 20 per cent. by weight of this mastic was mixed with 80 per cent. of sand (previously heated to the same temperature), in a cylinder provided with strong paddles. The mixing occupied about two minutes, when the charge was dumped into a cart standing underneath the mixer, whence it was conveyed to the bottom of the reservoir, there dumped upon wooden platforms, and thence taken in hot scoops to the spot where it was applied. The spreading and raking were similar to that described in the case of the other reservoir; but the compression of the asphalte was accomplished by means of hot instead of cold rollers, tamping irons, and smoothers—a method which executed the work in a superior manner to the former process. These rollers are formed from sections of cast-iron pipe, turned off smooth upon the outer surface, and fitted with a hanging fire-basket inside the cylinder, in which a fire was maintained. For the bottom work, a 30-inch pipe was used; and for the slopes, the pipe was only 10 inches, on account of the weight. This was pulled up the slopes by means of a ⅜-inch wire cable, passing over a pulley at the upper end. The result of hot rolling was to consolidate the sheet of asphalte into a compact mass; driving out the air, and producing more perfect cohesion of the particles than is possible by tamping, ironing, or cold rolling, for the reason that the asphalte is worked while it is still hot, and the roller passes over it so quickly, and presses it so thoroughly, that it has no opportunity to chill or cool off before it is compressed, and the hot roller keeps up its temperature until the work of consolidation is complete. Hot rolling is as essential to perfect work in asphalte, as thorough tamping is to successful results in cement concrete.

The weight of the mixture of asphalte and sand, after being compressed, was found to be 127 lbs. per cubic foot. The total surface area covered below the roof-line was 143,667 square feet; requiring 2,302,837 lbs. of the mixture, or about 16 lbs. per square foot. This gave an average thickness of the sheet of 1·53 inches. The sheet of asphalte was pinned to the slopes in a similar manner to that employed in the other reservoir; the pins being driven 1 foot apart in alternate rows, except when the shale was too hard to admit of the strap irons being driven into it. This occurred over about one-fifth of the area; and there heavy steel wire spikes were driven somewhat closer together.

The second or paint coat of pure asphalte was applied after the first coat was completely finished, and was thoroughly ironed with red-hot smoothers, to secure as perfect adhesion with the first coat as possible. This result was attained, except in spots where dirt had become ground into the surface of the first coat by the tramping of muddy boots after rain. The most satisfactory way to ensure perfect contact and cohesion of the two coats is undoubtedly to apply the second coat immediately after the first is laid, and while the latter is still warm and clean; but there were many little reasons and objections raised by the expert foreman to this method of doing the work, which might have been overcome, and should be overcome, in the execution of any similar work, to ensure the most perfect results. The thickness of the second coat is from ⅛ to ¼ inch. It has a leathery consistency, toughness, and elasticity; and although it manifests in warm weather a tendency to creep and gather in wrinkles down the slopes in both reservoirs, it never breaks and remains impervious to water. The total amount of asphalte used on the second coat of the east reservoir was 178,470 lbs., or 1·24 lbs. per square foot.

The cost of materials per square foot was as follows:—

	Cents.
First coat	8·98
Second coat	2·48
Total	11·46
Labour, fuel, spikes, &c., for both coats	1·99
Total for labour and materials	13·45

When the interior lining of the east reservoir was finished the slopes above the roof-line of both reservoirs were covered with a heavy coating of asphalte, 2½ to 3 inches thick. This was carried entirely over the top of the embankment between the two reservoirs, and for a width of 5 feet over the top of the banks surrounding them; forming a substantial pavement or pathway entirely around each, at a cost of $4218·59 for materials, and about $700 for labour.

The total expenditure on both reservoirs, on account of asphalte work, was $48,498·69, or about $1100 per million gallons of storeage capacity. A reasonable estimate of the cost of lining these reservoirs in an equally substantial manner with cement concrete, brick, or stone, exceeds this figure 100 per cent., although this was not the chief motive for adopting asphalte in preference to other materials.

At the time the west reservoir was lined, the embankments were fresh, and had been hastily constructed. The reservoir was imperatively needed for immediate service; and a material

for lining was required that would stand the vicissitudes of the emergency without serious impairment. The result proved the wisdom of the choice, as settlement did occur, although not so great as was anticipated. A fissure was opened in the lining about 10 feet below the roof-line, on the highest part of the made bank—the crack being some 6 inches wide and 100 feet in length; but it was repaired at an expense of $20 without drawing off the water. A severe test was applied in the winter season to the lining, to prove its tenacity and hold upon the bank. Ice formed to the thickness of 18 inches when the water stood within 8 feet of the top; and, while it was frozen fast to the lining all around, the water was lowered and raised again 3 to 4 feet, without the slightest injury to the asphalte. There was not the same urgent reason for lining the east reservoir with a flexible material, as the embankments had a year's settlement, and were reasonably solid; but with a year's experience in the west reservoir, and a feeling of confidence in being able to improve upon the method of lining, as well as upon the materials and mixtures, there seemed no good reason to change for a more costly lining.

A few of the special difficulties encountered in the work may be of interest in the way of suggestion. A small quantity of "seepage" water, following the seams in the shale near the bottom of each reservoir, had to be taken care of, and caused no little annoyance. It was insignificant in quantity—not exceeding one gallon per minute in all; and it was disposed of by cutting deep drains in the bottom and up the slopes as high as the moisture appeared, filling them about 1 foot deep with broken stone, covering them with plank, and then ramming in earth to the top. These drains converged to collecting-wells, into which short sections of 12-inch cast-iron pipe, with the bell ends turned upward, were inserted; and these were kept baled out during the progress of the work. The asphalte was brought up to these pipes, and well cemented to them. When the lining was completed, these pipes were capped with light cast-iron plates, fitting into the bells, in the centre of which was placed a 2-inch flap-valve made of sole leather, with an iron disc on the top to hold it in place against a pressure of a few ounces. These are sufficient to admit the water freely into the reservoir when it is empty, without exerting any appreciable lift upon the asphalte sheet, while they will close to prevent leakage when the pressure in the reservoir exceeds that of the subsoil waters. There are about 15 of these valves in the two reservoirs. They seem to serve in a satisfactory manner the purpose for which they were designed.

The crumbling of the surface of the slopes, when dry, especially after a little rain, caused no little inconvenience, as the dirt rolling down would become mixed with the hot asphalte as it was being applied to the slopes. To remedy this, a portion of the slopes of the east reservoir was plastered with a thin coat of cement, lime, and sand mortar, about ¼ inch thick. This, when dry, made a smooth, clean surface on which to lay the asphalte. The writer is inclined to the opinion that, wherever asphalte is used on earth slopes of reservoirs, this preliminary plaster coat should in all cases be applied; and it should be laid with care, nearly 1 inch thick. The cost should not exceed 5c. per square yard. On this should then be spread a thin coat of liquid asphalte, similar to the finishing coat, as the foundation for the paving mixture with sand, which latter may advantageously be reduced in quality to about 16 per cent. of mastic to 84 per cent. of sand. This method of lining would render the paving coat impervious to subsoil water as well as to the water of the reservoir, and thus preserve it from the slight tendency to softening under the action of water, wherever compression is not perfectly accomplished, and the sheet is at all porous. The finishing coat of liquid asphalte really constitutes the lining. The paving, or body coat of asphalte and sand, which is a body for the finishing coat to cling to, is only impervious to water where compression is absolutely perfect.

With the utmost care, there will always occur spots where compression is imperfect, due to a variety of causes, the most potent of which is inequality of "cooking," the occasional burning of a batch, the application of it at too low a temperature, the slight yielding of the foundation, the use of tools insufficiently hot, &c. For this reason, the writer recommends that the body coat be laid between two coats of the liquid or pure asphalte. By "pure" is meant a mastic containing at least 75 to 80 per cent. of bitumen. Under these conditions, and with the exercise of watchful care over every stage of the work, the writer believes that a reservoir lining may be made with asphalte that will be of indefinite service.

Death of Mr. J. Arnott, of Leeds.—The death is announced of Mr. John Arnott, who was for nearly twenty years Manager of the Newcastle-upon-Tyne and Gateshead Gas Company. It was under his superintendence that the gas-works at Elswick were erected. His general ability as a gas maker, and his special knowledge of tank and gasholder construction, caused his advice to be much sought by companies in the neighbourhood of Newcastle. He left that city many years ago to take the position of Constructing Engineer to the old Leeds Gas Company; and he remained with them for a considerable time. He afterwards commenced business on his own account as a gas engineer. He died at his residence, Belle Vue Road, Leeds, last Thursday, at the ripe age of 80 years.

REGISTER OF PATENTS.

Wet Gas-Meters.—Boult, N. J.; communicated from G. W. Gay, of Rosario, Santa Fé, South America. No. 5228; March 16, 1892.

This invention is designed to prevent the extraction of the water from wet gas-meters by tilting them, or blowing down the water supply-pipe or the connections to the gas-outlet of the meter, and thereby extracting the liquid through the waste-water chamber, in order to lower the water-level, and so admit of the passage through the meter of a greater quantity of gas than will be registered. When the meter is so tilted, all further supply of gas is cut off.

In this meter there is a reversal of the action of the drum (on the principle adopted by Mr. Charles Hunt in his compensating meter, and by Mr. Urquhart in his "Reliance" meter); the gas entering the body of the meter through passages in the valve chamber, and making its exit through the tube and box to the general outlet. The usual partition forming the two compartments is removed, and replaced by a bracket to support the bearings of the drum. The ordinary water overflow pipe or passage is prolonged through the waste-water chamber, to and along the bottom of the meter; and it is then continued up the back to a level just below the proper water-level, so as to form a second overflow for the surplus liquid down a continuation of the tube or passage, and returning along the bottom of the meter, and discharging into the waste-water chamber. A ventilating-pipe is provided, to prevent syphoning. Thus, when the meter is tilted, the liquid contained in it cannot be made to discharge through the overflow pipe or passage, as the second overflow point will be above the level of the water in the body of the meter. On the gas-outlet is formed a bottomless box or casing, into which is connected the gas-pipe; and in it is placed the liquid supply-pipe, so that, should a person blow down the gas-outlet or water supply-pipe, it will have no effect on the water in the body of the meter, as the pipes are connected direct to the waste-water chamber by the gas-pipe. Should the meter be tilted sufficiently to uncover the partitions of the drum, to cut off the passage of gas through the meter, a liquid seal is provided by so arranging a float-box and float, with an outlet sufficiently large to admit of the free passage of gas, placed just above the water-level, that when tilted the water will rise above the passage and seal the gas supply. In a modified arrangement, a Y-shaped pipe or passage is provided, which may be placed on either the gas inlet or outlet; and should the meter be tilted, the water rising will seal the passage of gas at the fork. By these appliances, the limit to which a meter may be tilted can be regulated to any desired point.

Fig. 1.

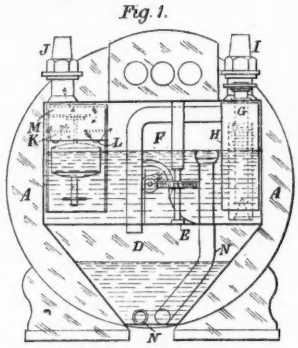


Fig. 2.

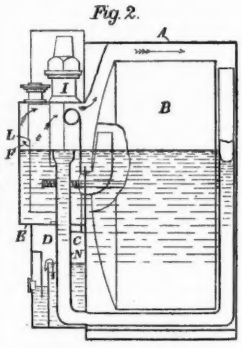


Fig. 3.

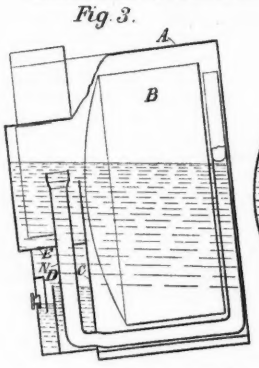


Fig. 4.

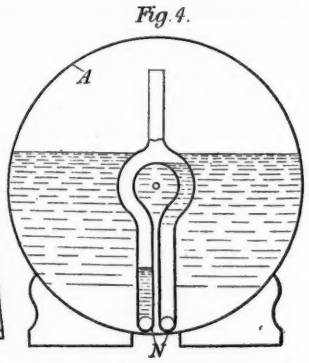


Fig. 1 is a vertical section of the meter; and fig. 2, a transverse section of fig. 1. Fig. 3 is a section showing only such parts as are necessary to the understanding of the operation of the invention when the meter is tilted forward; and fig. 4 is a section of fig. 2.

A is the body of the meter, in which the drum B is supported so as to freely rotate within it in any convenient manner. C is a partition which separates the waste-water chamber D from the drum chamber, and which partition may, if desired, extend a short distance above the plate E, to serve for supporting the front end of the drum spindle. If however, it is provided with perforations to admit of the water passing from the chamber F to the drum chamber, it may extend up to the top of the meter. G is the water-filling tube, which extends down to near the bottom of the chamber F; a casing surrounding the lower part of the tube, and having secured on its bottom plate a cone, the point of which extends slightly into the lower end of it. This water-inlet device may be arranged inside the casing H, from the upper part of which a bent pipe leads through the plate E to the chamber D. At the back, this bent pipe has secured to it an upturned branch (fig. 2), which extends into the drum B, and receives the gas from the compartments of the drum in the usual manner. The casing is closed at its top, except at the part at which the gas-inlet I is provided; and at

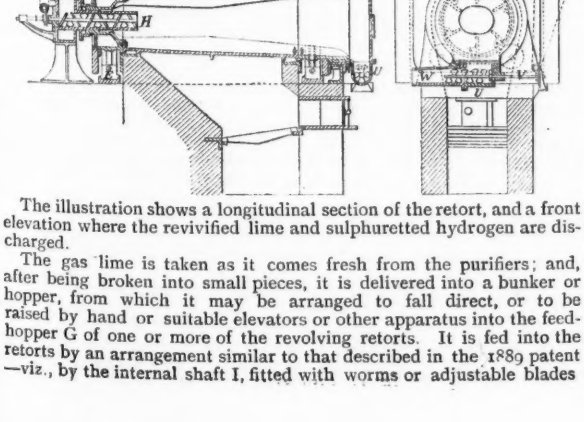
its lower part it is opened and dips down considerably beneath the surface of the water in the compartment F, and extends to near the plate E. The gas-inlet J is mounted at (say) the left-hand corner of the chamber F; but it is not in direct communication with the inside of the chamber—the gas before reaching the interior of the chamber having first to pass in the directions indicated by the arrows in figs. 1 and 2, through the float-valve apparatus K, and beneath the lower edge of the plate L, which forms, as it were, the front of a chamber M, wherein a valve and baffle-plates are mounted. The function of this float-valve apparatus is the same as that in other meters in which such apparatus is employed; but the plate L performs the special function of stopping off the admission of gas to the meter when it is tilted forward sufficiently to submerge the lower edge of the plate L, as shown in fig. 3. N is a pipe or passage, which has preferably a funnel-shaped mouth at its front end in the chamber F, and which passes down through the bottom of this chamber and through the chamber D, bends backwards through the partition or plate C (with which it makes a tight joint), and extends right to the back of the drum chamber A, between the back wall of which and the back of the drum B it extends upwards at one side of the drum axle, and passes down at the other side to the bottom of the drum chamber, and forwards beneath the drum B, and opens into the chamber D. At the part of the pipe or passage N at which it is bent over the axle, a ventilating-pipe is provided, to prevent the syphoning of the water. In the chamber D there are two plates—one adjacent to the pipe or passage N, and determining the level of the main body of the water in the chamber D, and the other in front of the plate, and between it and the overflow outlet, which is normally closed by a screw plug.

When the meter is standing level, and gas is admitted to it in the ordinary way, the gas passes through the inlet J, and (in the direction of the arrows shown in figs. 1 and 2) beneath the lower edge of the plate L, and between that edge and the surface of the water. The gas thus passing into the chamber F, then passes into the drum chamber A, through the drum B, which it actuates in the ordinary manner, and thence to the upper part of the chamber H, from which it passes through the outlet I. Should the meter be tilted forward, as shown in fig. 3, the lower edge of the plate L becomes submerged in the water; and thus the supply of gas is cut off. At the same time, no water can escape from the main body of the meter, because the only means of such escape would be by way of the pipe or passage N. The level of the water in this pipe is, however, lowered; consequently, it cannot pass over to the side connecting directly with the waste-water chamber D. Should the meter be tilted backwards, the quantity of water in the main body of the meter would not be appreciably affected, because the level of the water would be brought below the mouth at the front end of the pipe or passage N in the chamber F; so that, if any water at all passed away from this main body, it could only be a very small quantity, leaving one member of the pipe or passage N to pass into the other member.

The construction of the water-supply device is such as to preclude the possibility of the insertion of any tube or instrument for reaching the main body of water; the plates in the chamber D also preventing the insertion of any tube or implement through the outlet for withdrawing any appreciable quantity of water.

Revivifying Gas Lime.—Yeadon, J. A., and Adgie, W., of Leeds. No. 5239; March 16, 1892.

This invention is connected with the patentees' previous patent, No. 19,183, of 1889; and it consists in "the application or combination of the above-mentioned patent for a revolving retort or any parts of it; for the purpose of revivifying gas lime (sulphide of calcium) which has been used in the process of purifying gas or other analogous purposes; and, by subjecting such gas lime to the action of heat by passing it through a revolving retort, to eliminate the sulphuretted hydrogen or other materials which have been absorbed or taken up into it during the passage of the gas through the pure or fresh hydrated lime, and which are fixed or contained in the gas lime, and which sulphuretted hydrogen or other materials can afterwards be converted by condensation or other suitable methods into ammonia, sulphur, and other products, and after such a process of separation, the lime becomes revivified so that it can be used again for purifying gas or other purposes, and the component parts of the sulphuretted hydrogen can also be utilized if and as required."



The illustration shows a longitudinal section of the retort, and a front elevation where the revivified lime and sulphuretted hydrogen are discharged.

The gas lime is taken as it comes fresh from the purifiers; and, after being broken into small pieces, it is delivered into a bunker or hopper, from which it may be arranged to fall direct, or to be raised by hand or suitable elevators or other apparatus into the feed-hopper G of one or more of the revolving retorts. It is fed into the retorts by an arrangement similar to that described in the 1889 patent—viz., by the internal shaft I, fitted with worms or adjustable blades working through the bottom of the feed hopper and the internal pipe H; the closeness of the gas lime as it is fed in preventing any escape of the gas or other vapour that way. The gas lime falls upon the internal surface of the retort A, where it is constantly being broken up by the fixed internal blades. By this means, the sulphuretted hydrogen is quickly released and eliminated; and it passes out through the ascension-pipe T in the ordinary way to the condenser or into a chimney. The action of the internal blades along with the conical shape of the retort (or its angle of inclination when parallel retorts are used) gradually works the gas lime through the retort; and the revivified lime is delivered at the outlet end into the box U, which is fitted with an internal shaft V, having adjustable blades for forcing the revivified lime forward through the outlet-pipe W. This is preferably made taper, and smallest at the outlet-end, so as to secure its being filled with the revivified lime, and so prevent escape of gases or ingress of air.

The eliminated sulphuretted hydrogen passes out through the ascension-pipe T, as in the ordinary method of manufacturing gas; and it can be conveyed forward into a condenser or other suitable apparatus, in which the ammonia, sulphur, and other component parts are separated or extracted as required for further use.

Gas-Fittings.—Dungey, J., of New Cross Road, S.E. No. 5647; March 22, 1892.

This invention has for its object to provide for supporting hinged or jointed pipes by strengthening the support on which the pipes work, and combining with the support an automatic tap or cock, so that, when the hinged pipes are moved out of the way, the gas is automatically cut off. To accomplish this, a two-armed bracket is provided with a base-plate to enable it to be readily fixed in any desired position; and a conical plug is mounted in the arms and secured by a nut on its smaller end. A plug-barrel works on the plug, and is provided with a socket in which the pipes are secured. The plug is thus supported at both ends, instead of only at one end, as is usual. A passage leads from the socket to a port in the centre of the plug-barrel, and works in conjunction with a similar port in the plug. The port in the plug is in connection with a passage, either leading to a socket in the larger end of the plug or else through the plug to the bracket, and centrally through the base-plate. When, therefore, the barrel is turned in the plug, to move the pipes out of the way, the gas is shut off at the plug.

Gas-Engines.—Beugger, A., of Winterthur, Switzerland. No. 8538; May 5, 1892.

This invention has reference to the cooling of cylinders of (especially) portable gas-engines—the cooling being effected mainly by air. Water cooling, says the patentee, requires a considerable quantity of water; and even for stationary engines, it is very expensive to provide space for such a quantity of water, and practically impossible to carry it in the case of portable engines. This difficulty is said to be obviated by this method of cooling the cylinder by means of air and water, as only 1½ litres of water per horse power per hour are required.

The current of air employed for cooling is produced by a centrifugal blower, mounted on the crank-shaft of the engine. From the blower, the air passes into an annular space arranged round the pedestal of the engine cylinder; and thence upwards through a jacket, which encloses the cylinder, so that the air comes into direct contact with the outside of the latter. The jacket is open at the top; and its opening above the cylinder is slightly contracted, in order to retain the speed of the air-current until it passes into the atmosphere. For the purpose of aiding the cooling action of this air-current, the outside of the cylinder is provided with radially arranged ribs extending to the jacket, so that the air is compelled to flow through between the ribs. The cooling action of the air is further aided by fine jets of water forced against the wall of the cylinder from small pipes which project between the ribs. The water is forced by a small oscillating pump from a reservoir located under the framing of the vehicle. The water which is not evaporated on its way down between the ribs, collects in the annular space already mentioned, whence it flows back again into the water-reservoir.

APPLICATIONS FOR LETTERS PATENT.

3722.—Gould, R. H., "Regulation of gas-burners." Feb. 20.
3787.—Greenhough, G. H., "Gas-pendants." Feb. 21.
3802.—Guild, A., and Barry, Henry, and Co., Limited, "Spiral conveyors and their fasteners." Feb. 21.
3815.—Paisley, J. R., "Manufacture of water gas." Feb. 21.
3891.—M'Cann, J., "Lighting fires by application of gas." Feb. 22.
3971.—Hartley, J. W., and Kerr, J., "Gas-engines." Feb. 23.
4047.—Eckersley, J., "Automatic apparatus for extinguishing, reducing, and igniting gas-flames from burners or the like." Feb. 23.
4076.—Meldrum, J. J. and T. F., "Gas-producers." Feb. 24.
4112.—Pease, E. L., "Gas-washers and ammonia-stills." Feb. 24.
4209.—Tripler, C. E., "Compound gas motor." Feb. 25.
4210.—Tripler, C. E., "Gas-condenser." Feb. 25.
4225.—Bedford, W. G., "Generation of gas from water, steam, and the like." Feb. 25.

The Electric Light in New York.—The business of the Edison Light and Power Installation Company in New York has greatly increased during the last four years. The number of customers in 1892 was 4344, as compared with 2875 in 1891, 1698 in 1890, and 1213 in 1889. The number of 16-candle lamps owned by the Company was 142,492 last year, as compared with 94,485 in 1891, 64,174 in 1890, and 39,815 in 1889. The number of motors in operation in 1892 was 3807, as compared with 2000 in 1891, 677 in 1890, and 490 in 1889. The number of arc lights in 1892 was 1637, as compared with 841 in 1891, 254 in 1890, and 110 in 1889. Estimating each motor and each arc light as equal to ten 16-candle lamps, the present installation is equal to 196,932 lamps. The gross earnings of the Company last year were $963,021, as compared with $675,505 in 1891, $488,595 in 1890, and $327,678 in 1889. The net earnings in 1892 were $475,138, as compared with $347,229 in 1891, $229,078 in 1890, and $124,031 in 1889.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Testing for Sulphuretted Hydrogen.

SIR,—I shall not quarrel with Mr. Vernon Harcourt over his letter in this week's JOURNAL. I can make great allowance for him, because he has not had the "practical knowledge and experience in the manufacture and supply of gas" which the Act of Parliament requires that "one at least" of the three "competent and impartial persons" who act as Referees should have. This, however, is not his fault, but that of the Board of Trade, who, since the resignation of his refereeship by the late Mr. F. J. Evans, then Chief Engineer of the Chartered Company, have persistently disregarded the above-quoted express directions—emphasized by repetition—of the Acts of Parliament.

I have sometimes thought it would be well, though I have never been cruel enough to wish, that Mr. Harcourt should have twelve months' experience of the responsibilities and the anxieties that the prescribed system of testing imposes on the Engineers of the London Gas Companies. Their position is thereby converted from one of great interest and satisfaction in their work, to that of constant anxiety without relief at any time; and this state I say deliberately is most detrimental to the public interest, because, besides the worry, a large proportion of the time and the attention of the Engineers is absorbed by trivialities, instead of being given exclusively to weighty matters whereby the manufacture and supply of gas can be improved and cheapened. I know I was not far wrong in my assertion at our recent general meeting, that the fads of Parliament and of chemists—past, if not present—cost the consumers of London something like 2d. per 1000 feet, or about a quarter of a million sterling a year, for which they get very little. It is the consumers, and not the Companies, who pay; while the latter are prevented from doing their best for the consumers, with whom, under the sliding scale, they are in very real partnership.

As to the test for sulphuretted hydrogen—for which impurity, by the way, this Company have never been fined—can anyone contend that the intention of Parliament was anything more than that it should be of such a nature as to show any quantity that would be in the *slightest degree* objectionable—such as the three minutes' exposure of a lead paper to a small quantity of gas prescribed in the Gas-Works' Clauses Amendment Act of 1871, which is quite sufficient, if applied once in 24 hours, to show whether any appreciable quantity has passed through the mains during the interval? In proof, I may say that I have known a very short length of main, through which foul gas passed for a short time, contaminate clean gas (as shown by rapid staining of the lead paper) constantly flowing in large quantity through that main for a week; and on mentioning this fact to the late Mr. Harris, he entirely corroborated it from his own experience.

My statement as to one part of sulphuretted hydrogen in 100,000,000 parts of gas or air was the result of direct experiment—not by putting a pint of sulphuretted hydrogen in 2,000,000 feet of gas, and taking the chance of its diffusion through the mass, but by putting a measured quantity—1 foot—into a 10-feet holder, then emptying it to 1 foot, and refilling with gas in one experiment, and with air in a different holder in another, then again emptying to 1 foot and refilling, and so on—the surface of the water in the annular tank being protected with oil. It certainly seems incredible that so small a proportion should stain the lead paper; but stained it was, though I am free to admit that it was possibly due to the contamination of the gasholder and the pipes. Whether the effect on the lead paper was produced directly by the gas, or indirectly by the probably contaminated surfaces, matters little. The test is inconceivably sensitive; and on such a test the Companies are liable to a fine of £50.

I can take the words of Mr. Harcourt, "he strikes out a little blindly," and "he gives fractions which are a hundred times too small," in the same spirit of good humour as that in which they were written; and I can do more. I can afford to take his own admission, contained in the last quotation, that lead paper will detect one part of sulphuretted hydrogen in 1,000,000 parts of gas, although Professor Attfield last week (when giving evidence) assented to my figures; and last Monday Dr. Stevenson said in evidence that lead paper would detect 1 part in 10 million—whether it is $\frac{1}{10000000}$ or $\frac{1}{1000000}$ or $\frac{1}{100000}$ is of very little consequence. On Mr. Harcourt's figures, the Gas Companies are liable to a fine of £50 if there is one grain of sulphuretted hydrogen in about 4500 feet of gas; although this gas must at the best contain many hundreds of grains of sulphur in other forms. I understand the Chief Gas Examiner last week decided in favour of the Chartered Company in their seventeen sulphuretted hydrogen appeals, on the ground that the tester had not prepared the lead papers in the manner prescribed by the Referees; while he (the tester) contended that in a London atmosphere it was impossible so to prepare them. This is an apt illustration of the absurdity of the testing arrangements, which no doubt, as Mr. Harcourt will contend, are in strict accordance with the letter of the Act of Parliament, and are evidence of its wisdom, or the reverse.

I have written this, not with the desire or intention of entering into a controversy with Mr. Harcourt. My object is to show that these parliamentary restrictions and regulations are not in the interest of the consumers. With all the vexatious conditions as to testing, I can say, from my own knowledge, that no practical or perceptible advantage has accrued to the consumers, though they, on whom the whole cost falls, have had to pay dearly for them. Parliament and public bodies have, as a rule, regarded the interests of Gas Companies as antagonistic to those of the consumers, which I admit was to a considerable extent the case before the introduction of the sliding scale and its complement, the auction clauses. Unfortunately for all parties, this conviction on the part of public bodies still exists in much of its old force. They have much to unlearn; for they cannot yet see that the partnership of consumers and companies is real and effective, and their interests identical under the sliding scale.

But it is only fair to add that neither have the companies fully learnt this truth. Gas companies have now no monopoly in the supply of light; the last 20 years having brought into the field two active competitors—viz., cheap oil on one side, and dear but attractive electricity on the other. The old conditions have gone; and the companies must adapt themselves to the altered circumstances, as if they were ordinary traders subject to competition. I ask for fair play—for a fair field and no favour, to enable them, unhampered by useless and mischievous regulations, to do their best to supply the wants and to deserve, if they do not obtain, the goodwill of their customers.

GEORGE LIVESEY.

March 4, 1893.

Air v. Oxygen for Gas Purification.

SIR,—I have read with very great interest Mr. C. C. Carpenter's paper on the above subject, and also the remarks in his presidential address to the Southern District Association. Mr. Carpenter has done excellent work; and he deserves the best thanks of gas engineers for putting this method of using air so plainly before them.

Mr. Carpenter says he uses four lime purifiers—the first three taking up carbon dioxide only, and the fourth one made active for removing the bisulphide of carbon by passing in about 1 per cent. of air. He also finds that it is not necessary to keep the air continually passing into this purifier, but that it is sufficient to pass a certain quantity when the purifier is freshly charged with lime. Everything up to this point is quite clear. But Mr. Carpenter further says that the greater part of the sulphuretted hydrogen goes forward to the oxide of iron or Weldon mud purifiers, although he does not say what steps he takes to revivify the oxide *in situ*, so as to keep it active for a long period without removal from the boxes. For this purpose 0·1 per cent. of pure oxygen would be required for every 100 grains of sulphuretted hydrogen. This would be equivalent to 2 per cent. of air if 400 grains of sulphuretted hydrogen were present; so that it would require 2 per cent. of air to keep these oxide purifiers going. I would suggest that this quantity of air should be passed into No. 1 oxide box continuously, and an arrangement made to switch the air on to No. 4 lime purifier when required.

Mr. Carpenter virtually says that air is as good as pure oxygen for the above purposes. This is entirely at variance with my experience on the point. Oxygen has been found to be much quicker and more intense in its action than air.

With regard to illuminating power, Mr. Carpenter and others maintain that air used during purification does not *reduce* the illuminating power; and that this is probably due to the rise in the temperature of the purifiers, which I suppose prevents deposition of some hydrocarbons. This may be true; but does it prove that air is as good as pure oxygen? It does not, because the same rise of temperature occurs when oxygen is used—in fact, the temperature is higher—and the increase in illuminating power is not counterbalanced by the diluent effect of the nitrogen, as with air. To this fact is due the increase in illuminating power when oxygen is used, not to the presence of any free oxygen that may remain in the purified gas, although small percentages of oxygen mixed with the purified gas do increase the illuminating power of the flame.

Now, at least 1$\frac{3}{4}$ per cent. of air would be required—some in No. 4 lime purifier, but the greater portion in the oxide of iron boxes; and 1$\frac{3}{4}$ per cent. of air would equal 0·35 per cent. of pure oxygen. Air does not decrease (?) or increase the illuminating power of the gas, but 0·35 per cent. of oxygen would increase it by one candle—from 16 to 17 candles. When the original gas is 14 candles, the increase has been found to be over 2 candles with 0·5 per cent. of oxygen. Suppose we take the cost of raising 16-candle gas to 17 candles as 1$\frac{1}{2}$d. per 1000 cubic feet of gas for oil or cannel, and put against this the cost of 0·5 per cent. of oxygen for the same purpose, taking the oxygen as costing 5s. per 1000 cubic feet, this would be 0·3d. per 1000 cubic feet of gas; showing an advantage of 1·2d. in favour of pure oxygen used during the process of purification.

W. G. HICKS.

Ascot Gas-Works, March 2, 1893.

The Investment of Reserve Funds.

SIR,—Some secretaries of gas companies may be interested in a discussion about "Investments of Reserve Funds," and the points raised by "A Secretary" may be of great interest; and I think there is no doubt that "A Secretary" has formulated a correct opinion when he writes: "The points raised are in many instances very imperfectly understood." Yet one point is really a question of book-keeping by double entry, as far as secretaries are concerned; and the other is a question which must be left for the directors to answer—*i.e.*, as to apportioning amount of profit earned to a reserve fund account, and allowing available surplus cash to be tied up in investments. I will reply to "A Secretary's" points in the abstract.

The maximum of £5000 of the profit has been transferred from the profit and loss account to an account nominated "Reserve Fund." These two accounts are *nominal*. Then, after a time, £5000 has been drawn from the cash account for payment and possession of Government securities. Therefore this cash account should be posted to an account styled (say) "Investment (Reserve) Account." These two latter accounts are *real*.

A reserve fund, being a nominal account pure and simple, has no up-and-down movement, except by transfer; and £5000 can remain stationary, until losses or insufficient profits necessitate a re-transfer of all or part of this £5000 being made to the profit and loss account. As regards the £5000 invested, the securities purchased need only be valued by experts at such times as the balance-sheets are rendered. If the investment be a good one, a foot-note might be made as to its then estimated value. But if the market value should show a loss, then the investment (reserve) account should be credited by transfer from the profit and loss account, and there can be a re-transfer from time to time, if the market value warrants it; but, of course, not beyond the £5000 maximum.

In reference to interest or dividends received by the company by their holding securities, the amount so received should be posted to a *nominal* account, styled (say) "Investment Interest Account;" and the periodical balances would be transferred to the profit and loss account, or it might be posted to the profit and loss account *direct* as a profit. I prefer the former method.

A safe investment may be good policy; but if securities be sold merely because of a rise in the market, it savours of speculation. In fact, all investments are more or less speculative as to their cost and as to their selling price.

Supposing the securities bearing reference to the *actual* investment (reserve) account are sold for £5500, the account would show a profit of £500; and this profit must be transferred to the profit and loss account if you leave your reserve fund at the maximum of £5000 (to open a special account for this £500 profit, and name it "Premium," would be a blind-entry), and when the £500 has been posted as profit, it is thus got rid of, and the account closed *pro tem.*

As regards the £5000 invested bringing an annual return of £165, this £165 is *practically* an income from the investment of £5000, and is not an income from any supposititious market value. The former is fact; the latter would be theory.

Directors and shareholders like to read in balance-sheets "Reserve Fund," and "Investments" *per contra*. These entries may be pleasing to the inexperienced eye; but when one sees "Cash loans" ranking with other liabilities, it reads like high finance, which means not keeping personal touch with your own finances. Investments of the funds of manufacturing and trading companies are not necessary for earning income, and should not be encouraged. A *limited* reserve fund is a most desirable "nominal" account as a liability, while one reads *per contra* **real** and personal accounts in the ranks of assets.

March 2, 1893. FACTOTUM.

The Recent Action against the Incandescent Gas-Light Company.—We are asked by the Secretary of the Incandescent Gas-Light Company, Limited (Mr. L. de Fonblanque), to allow him to explain, in reference to our report of the recent proceedings against the Company, given in the JOURNAL last week, that the patented burner and mantle support now issued by the Company are of a totally different pattern from those claimed by the plaintiff in that action.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bill committed: Staines and Egham District Gas Bill.

Bills referred to a Select Committee, consisting of Lord Lauderdale (Chairman), Earl Chesterfield, Lord Sinclair, Earl Russell, and Lord Norton; to meet on Tuesday, March 7: Accrington Gas and Water Bill, Bilston Commissioners Water Bill, New Swindon Gas Bill, Stockton-on-Tees Corporation Gas Bill, Todmorden Local Board Gas Purchases Bill, Wolverhampton Gas Bill.

Bill referred to a Select Committee, consisting of Lord Hamilton of Dalzell (Chairman), Earl Stamford, Viscount Bangor, Lord Wimborne, and Lord Newton; to meet on Monday, March 6: Ilkley Local Board Bill.

Bill read the third time and passed: Imperial Continental Gas Association Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Further Standing Orders complied with: South Staffordshire Water Bill.

Bill read the first time, and referred to the Examiners: Imperial Continental Gas Association Bill.

Bill to be considered by a Select Committee, consisting of Mr. Coddington (Chairman), Mr. D. Crawford, Mr. Ainsworth, and Mr. Arnold Forster, to meet on Tuesday, March 7: East London Water Bill.

Bills referred to a Select Committee, consisting of Sir R. Temple (Chairman), Mr. Lyell, Mr. Hozier, Mr. S. Howard Whitbread, and Mr. Bonham-Carter (Referee); to meet on Tuesday, March 7: Devonport Water Bill, East Stonehouse Water Bill, Plymouth Corporation Water Bill, South Staffordshire Water Bill, West Hampshire Water Bill.

Petitions against the Plymouth Corporation Water Bill and the East Stonehouse Water Bill were presented from Henry Elliot Tracey-Elliot.

Additional Carbonizing Plant at the Guernsey Gas-Works.—Messrs. Jonas Drake and Son, of Halifax, have received orders from the Guernsey Gas Company for the erection of a retort-bench of six through ovens, each to contain eight clay retorts, with generator furnaces, fittings, and mountings complete.

Heckmondwike Local Board and the Gas Company.—At the meeting of the Heckmondwike Local Board yesterday week, a letter was read from Mr. J. Stead, Chairman of the Heckmondwike Gas Company, in reply to the communication from the Board (see *ante*, p. 328), stating that the Company complained that the action of the Board lately had been of such an extraordinary nature as to put them outside of that consideration they would otherwise have commanded. The questions the Board had asked had reference to management; and the Directors were under no legal obligation to answer these, as their appointment and responsibility rested with the shareholders. The Company, he would state, were taking such steps as they and their Manager deemed best to lessen the alleged excessive loss in leakage, and hoped their efforts at the end of June next would show a considerable improvement. Respecting the second question asked, the Board had already been furnished with the Company's accounts to June 30. It was mentioned, in the course of the proceedings, that the letter of the Board asked for particulars of the leakage up to the end of 1892, which the accounts referred to did not supply; and it was resolved to repeat the question.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, Feb. 27.

(*Before Mr. Justice* ROMER.)

Attorney-General v. Ystrad Gas and Water Company.

This was an action brought by the Attorney-General, on the information of the Ystradyfodwg Local Board, to restrain the defendants from polluting a stream from which the inhabitants of the locality draw their water supply.

Sir R. E. WEBSTER, Q.C., M.P., Mr. NEVILLE, Q.C., and Mr. FORD appeared for the plaintiffs; Mr. BALFOUR BROWNE, Q.C., Mr. ABEL THOMAS, Q.C., and Mr. VERNON SMITH represented the defendants.

Sir R. E. WEBSTER, in opening the case, said it would depend mainly on the evidence; and therefore would not require any lengthened argument. The defendants were a statutory Company, carrying on business under Private Acts of Parliament; and the case stated was that they allowed polluted water from certain collieries to flow into the stream from which their supply was drawn. Attempts had been made to intercept this pollution; but it would be shown that they were ineffective, except in very dry weather. This, however, would be one of the main contests in the case—whether the precautions taken were sufficient. The plaintiffs suggested that the defendants ought to carry their intake to a point farther back, where they would be able to obtain the water in a pure state. There was also a contest raised by the defendants as to the extent of pollution which had actually taken place. In January, 1890, a Ratepayers' Association was formed; and in August of that year, a summons was taken out against the defendants for not supplying pure water, but it was dismissed on a technical point. In 1892 a Committee of the Local Board had the collieries inspected, and found that the levels from which water ran into the stream were polluted with human and animal excreta. A report was made to this effect in May; and a copy was sent to defendants, who, however, disputed its accuracy. In June a second inspection was made by the Committee, in company with the defendants' Manager, when they again found evidence of pollution, which was running into the stream a few yards above the intake. The writ was then issued; but the same state of things continued. He understood that one defence would be that the water, on analysis, was found to be pure; but, of course, it was well known that chemical analysis was not able to detect organic pollution of this character, unless it was very great, although it might be highly dangerous to life. There were express provisions in the Act of Parliament that pipes should be provided to carry all pit water into the stream below the reservoir. These were evidently put in for the protection of the public. The defendants said they had no powers to make works to take the water higher up; but he (the learned Counsel) submitted that this was no answer.

Justice ROMER remarked that, if a pollution dangerous to the public health was established, he had nothing to do with the question of how it was to be cured.

Mr. *J. R. James*, M.R.C.S., Medical Officer of Health for the district, described the *locus in quo*, known as the Rhondda Valley. It was surrounded by very steep hills, in which there were levels cut for working the collieries; and a tramway ran along in front of them about 15 feet above the river—crossing the river by a bridge just below the waterfall. In May, 1892, in company with four members of the Local Board, he inspected the colliery levels. There was a strike on then, and no one was at work; but they recommenced in November. There appeared to be no sanitary accommodation for the miners; and he found in a disused level an "air-way," a few yards in, and also in level No. 3, a quantity of human filth. Water flowed out of these levels, over the tramway, and into the river. A large quantity of water percolated into these levels; and some of it ran out at the mouth. Near the fall on the other side of the river was an air-way in which he also found filth. The spray from the fall was carried into the mouth of the air-way; and it then soaked through, and ultimately found its way into the river. There was also a brook flowing into the river, which was found contaminated. Witness then detailed the system of drainage adopted to carry off the foul water from the levels, which he described as wholly insufficient. There was an iron pipe, 1½ inches in diameter, intended to carry it below the intake. But it was broken; and the water escaped above the intake, and found its way into the river. He produced a large bottle full of water taken from the river in 1890, which was very foul before any drainage was attempted. The drainage might in some cases be sufficient in very dry weather, but not when there was much water coming down; and, in other instances, the drainage was palpably insufficient. He then described a second visit to the place on the 1st of June, accompanied by Mr. Baynes, the defendants' Manager, when much the same state of things was found. Mr. Baynes was asked by the Secretary of the Chamber of Trade, who accompanied the deputation, how it was that he had such good reports of the water. His reply was that they had such a large volume of pure water coming down, that a little filth did not tell. A report was then drawn up, and signed by all present except Mr. Baynes, who, however, said he did not object to the wording of it. On the 1st of July he (witness) was at the place again, and found certain improvements had been effected. Work at the collieries was resumed in November; and on the 28th of that month, he visited the place again, and discovered fresh filth there, and dirty water from the tramroad (on which horses were working) was flowing into the river in a great many places. On the following day, he went again with Mr. Abraham, M.P., and other gentlemen; and several deposits of filth were noticed—some of them being fresh. A report was made; and the same thing was repeated two days later. The report then drawn up was, he thought, a little too strong in its language, though he signed it. On Jan. 2 last, he paid another visit to the intake late at night, and found all the water from the river flowing in, though the defendants had made an affidavit that they were not taking in water there. On Jan. 20 he was there again, in company with the Vicar; and he then found filth on the ice of the river, and in several adjoining places. Subsequently he went again with Dr. Williams, a member of the County Council, but he did not make any notes of that

visit; and again in February with Dr. Stevenson. There were in his district something like 100,000 inhabitants, about half of whom, or rather less, were supplied by the Company. There could be no doubt water contaminated as he had described was dangerous to the public health. A good chemical analysis would not alter his opinion. He had had experience of cases where an epidemic had been traced to polluted water.

Cross-examined: He was not a chemist by profession; but he thought he could make an analysis. The most important test for water was to examine it with the naked eye. He knew the process of examination by "culture," but he had not applied it in this case. The means he had described were intended to keep out the pollution; but they were not effective. The tramway was about three-quarters of a mile long; but he could not say what was the length of the levels. There was no water supply in the country absolutely free from contamination from sheep, cattle, horses, &c. Oil also might get into this water. He was not a geologist; but he knew there was impervious clay under the gravel in some places. He thought it was mostly marl, not impervious to water. On many of his visits he made notes; but he had not them with him there. He had a piece of paper copied out about a fortnight ago from his original notes. The greater number of the people in his district who were not supplied by the defendants obtained their water from the Pontypridd Company. He complained that the Company did not filter the water efficiently—they had not sufficient filtering area. He judged by the water supplied, a bottle of which he produced, and also by analyses of water which he had mixed with human filth, and sent for analysis to the defendants' chemists. He had never had analyses made of the water unmixed. He procured these analyses to show the value of chemical tests. There was no harm in healthy sewage, in small quantity, getting into water; but there would be great danger if an epidemic broke out. The excrement in the levels would do no harm unless it found its way into the river. This was a rocky precipitous stream, which would have a considerable action in oxidizing organic matter. He had heard of experiments in this direction; and opinions differed very greatly as to the time required to get rid of it altogether. He understood that proper filtration would remove 97·7 per cent. of microbes and pathogenic germs. A system of sewerage was being carried out in the Rhondda Valley; it had been going on for two years. The sewage went into the river below the intake. He had not put in his affidavit all the matters of which he complained.

Mr. *G. Chatterton*, M.Inst.C.E., said he was the Engineer for the sewerage scheme now being carried out in the Rhondda Valley. He visited the place in question in the summer of 1892, and also recently. He described what he saw, which was generally in accordance with Dr. James's evidence.

Cross-examined: He had had large experience in sewage and water supply matters. The ground was in an amphitheatre, with steep hills round, and flat ground near the river. He made an affidavit in August last, in which he only referred specifically to two causes of complaint. He was cross-examined in detail as to the various workings, and the drainage of them.

Mr. *J. Ray*, of Pentre, a mining engineer, and a member of the Local Board, spoke to the results of his inspection of the place, in company with Dr. James, the first witness. He signed the report of the 10th of May.

Mr. *E. H. Davis* gave corroborative evidence of the same character; he having gone, as Chairman of the Chamber of Trade, on June 2 to visit the spot. Mr. Baynes said he could not sign the report, though he could not say anything against the wording of it.

Mr. *G. Shepherd*, the Secretary to the Rhondda Valley Chamber of Trade, also gave similar evidence. He said he saw filth in several places in the levels, on more than one occasion.

Tuesday, Feb. 28.

On the resumption of the proceedings this morning,

Mr. *Shepherd* was shortly cross-examined by Mr. THOMAS.

Mr. *W. Abraham*, examined by Sir R. E. WEBSTER, Q.C., said he was Member of Parliament for the Rhondda Division, was a miners' agent, and had all his life been acquainted with colliery work. On Nov. 27 last, in company with others, he visited the district from which the defendants obtained their water supply; and found evidence of human excreta. At the disused level there was abundant proof of the same thing; and the water from the level was overflowing the inner rail of the tramway, and finding its way out through holes under the rails on the other side, and so down the embankment into the river. At other places also he noticed human excreta; and some had undoubtedly been washed into the river. There was a good deal of fallen rock and *débris* in the locality; but it was of such a nature that the water would easily percolate through it. As to the tramway, he observed 26 or 27 instances where the water had passed across. From his knowledge of the habits of colliers, and of the physical difficulties of the place, it was impossible, in his opinion, to keep the filthy water and excrement from getting into the river.

Cross-examined: He went to inspect the place solely in the interests of the men he represented. At one level (No. 3) excrement was in the mouth of the level, and the water overflowed into the river. There was no fencing round the old disused air-way, so as to prevent people getting into it.

Mr. *W. Mathias*, a railway contractor of considerable experience in the construction of works, said he visited the spot in question on the 5th of February last, and found the same state of things existing as had been described by other witnesses. Some of the filth he pointed out to Moses Jones, an inspector in the service of the Company. If anything happened to the grip cut, nothing could prevent large quantities of filth passing into the river. The grip had been cleaned out when he saw it. He did not consider an open grip to be a satisfactory way of carrying off the water; neither did he believe the intercepting drains put in by the defendants to be a good arrangement.

Rev. *W. Lewis*, Vicar of Ystradybodwg and Rural Dean, said he visited the land below the waterfall on the 20th of January last, when he was accompanied by Dr. James. He saw a collection of human excreta on some rubbish, and covered with ice; and it was in such a position that the water flowing over it must have carried it into the river. He saw other collections of filth between the waterfall and the bridge over the river. The water in the grip became less as it went below the intake, and there was evidence that it percolated into the river.

In cross-examination, witness said he made notes, though he did not expect to be called upon to give evidence in this trial, but only that he might be asked by the Local Board to state his impressions.

Other witnesses residing in the district also gave evidence to the effect that large quantities of filth could be found there, some of which must, they thought, get into the river.

Dr. *T. Stevenson*, examined by Sir R. E. WEBSTER, said he visited the locality in January last. It was a dry day, and the two previous days had been dry. Assuming filthy water to come over the tramway, it would certainly get into the river. He went into all the levels and air-ways, except one that was closed up, and saw human excreta in all of them. He had no doubt that water came from the tributary brook, and, after washing over the filth, got into the river. The water, if not otherwise impure, was made so by flowing over the obviously dirty soil. It was a matter of prime necessity that water supplies obtained from some considerable distance should be absolutely prevented from contamination; and that was not the case in this instance. Human excreta was one of the most dangerous contaminators of water, and the poisonous element could not always be detected by chemical analysis. From his experience, it was not a proper place from which to take the water at the intake. If any of the men from the collieries were suffering from acute diarrhœa, typhoid fever, or cholera, it would be a very great element of danger to people drinking the water. As he understood it, the Company's intake was by means of partially an open and partially a covered culvert; but in his opinion there was not sufficient length of open-air culvert to deprive the water of noxious elements or germs it might contain. From what they knew of the typhoid germ, it grew in darkness, but was destroyed by light.

In cross-examination by Mr. BALFOUR BROWNE, witness said he had not made any analysis of the water. When he visited the place, there was no evidence of pollution. He had seen the analysis of the water by others, and it was satisfactory. Speaking as a chemist, he had nothing to say against the water. Typhoid bacilli had been carried by running water; but those of cholera had not been traced from running water. He believed some towns sent into the Thames crude sewage in which disease had been traced; but, if there was sufficient sun, he believed that a run of 10 or 12 miles would be sufficient to kill the germs of disease. Supposing the germ was exposed to sunlight, it would be destroyed in about five minutes; and therefore it would not require a run of 10 or 12 miles to render it inoperative.

Dr. *W. Williams*, Medical Officer of Health to the Glamorgan County Council, said he had visited the locality from which the defendants took their water supply, and he had distinctly seen polluted matter going into the river above the intake. Chemical analysis was not sufficient to detect all dangerous elements in water containing human excreta.

This closed the plaintiffs' case.

Justice ROMER asked what evidence there was on which he could act, and decide that the water was polluted.

Sir R. E. WEBSTER said he thought the fact that the bed of the river above the intake received the polluted water spoken of was sufficient evidence. His case did not rest upon chemical analysis, because this would not show an absolutely polluted water.

Justice ROMER said he would hear the other side, for the reason that, as this was a question of great public importance, it would be more satisfactory to the inhabitants if the defendants' case was gone into.

Mr. BALFOUR BROWNE said that, though he would like to have the action dismissed at once, it was perhaps better, in the interests of the defendants, that it should be threshed out. The case arose from a certain amount of ill-feeling. In 1890 the defendants asked Parliament for further powers to take water; and their application was opposed by the Local Board, on the ground that the supply should be in the hands of the public authority. Ultimately the Company said they had no wish to stand in the way of the Board, and that they were prepared to enter into an agreement with them for the sale of their works; but that they must first get their Act for additional powers. The agreement for the purchase of the works, at a proper valuation, was entered into; but, upon applying to the Local Government Board, sanction to purchase was refused, and the works remained in defendants' hands. It was in consequence of this that there had been some ill-feeling between the two bodies. It would be found that the Local Board were before his Lordship not to complain so much of the water, as to force upon the defendants a scheme for putting a pipe above the waterfall. They had no authority to do this, as Parliament had sanctioned the Company's right to take the water from where they obtained it. All through the trial, they had not heard one word said against the purity or the wholesomeness of the water. All that plaintiffs' witnesses had stated was that the source was not a good one, and that certain measures which the Company had taken to obviate any disadvantage were not efficient. In order to remove even the suspicion of anything being wrong, the Company had put in pipes and constructed works to take away all the sewage from the levels, though they were not bound to do so. However, he would not dwell upon the matter, but would at once call his witnesses.

Mr. *T. Reece* stated that the steps taken by the Company to prevent pollution were commenced in 1891. By his advice an open grip was constructed, and intercepting pipes laid to carry off the sewage to a point below the intake. The bed of the grip was in clay soil, and therefore the water would not percolate through it. He also advised that a man should be placed to look after the intake and intercepting pipes, so that they should not get choked up, or interfered with.

In cross-examination, witness said he had inspected the locality on many occasions. He had heard of complaints being made, but had not read any of them. They would be sent, in the ordinary course, either to the Secretary or to the Solicitor of the Company.

Wednesday, March 1.

The hearing of the action was concluded to-day.

Mr. *G. H. Hill*, M.Inst.C.E., said he was consulted by the defendants when they applied to Parliament for powers in 1890; and he

knew the district well. He visited the place on the 11th of February last, and inspected the levels and means of diverting any polluted water to a point below the intake. He found that the steps taken by the Company were most effective. The filter-beds were of proper construction; and the water supply was exceptionally fine.

In cross-examination, witness said the drains were working very well when he was at the place. For the purpose of avoiding contamination of the water, an open grip was in this instance a satisfactory provision, but the volume of water was small, and there was not much soft ground that was likely to block up the grip. Catch-pits prevented loose pieces of matter getting into the grips. There were already two of these; and more could be added if it was thought they would be of advantage.

Re-examined: These gutters and the drains were sufficient for what they were expected to do.

Dr. *E. Frankland*, F.R.S., said that on the 16th of February last he visited the locality in question, and inspected the Company's gathering-ground and filtration plant. Heavy rains had then recently fallen; and the valley seemed alive with water. That at the intake was remarkably pure; he had never seen, in a mountainous district, water so free from fœtid matter. He examined the catch-pits, and found the water was flowing freely through them, and into the pipes laid to convey the water away to a point below the intake. He did not find any polluted water flowing down into the river. Samples were taken by him of the water from the intake, from the filter-beds, and from a house supplied by the Company from their mains. The samples did not contain a trace of sewage contamination. The effect of filtration by sand had only been investigated during the last few years; and the exact result only within the last ten months. They were very surprising, and had quite revolutionized people's ideas of water supply for domestic purposes. Sand filtration removed from water nearly all—in some cases absolutely all—the micro-organisms which found their way into water. There might be any kind of organic pollution in the water; but if there was no living matter, it would not produce any deleterious effect on men or animals.

In cross-examination by Sir R. E. WEBSTER, witness said he had repeatedly expressed the opinion that no amount of filtration or running was sufficient to render the poisonous germs of typhoid or cholera excreta innocuous. He was of this opinion until a short time ago; but he had been compelled to change it. He did not think he had gone so far as to say that no chemical analysis was of any value unless the source of the water was free from the possibility of contamination; but he had said that chemical analysis was incapable of distinguishing between noxious and innocuous sewage. If he found no trace of sewage, he should conclude that, so far as chemical investigation went, there was no danger. Experiments, which had been carried out in connection with the London water supply, had revealed the fact that water filtered through 3 or 4 feet of sand was equal in quality to deep-well water. It was not yet clear whether deep filtration was better than shallow; but, for the time being, it was preferable to use the former. In the absence of filtration, it would be dangerous to allow water polluted by human excreta to go into the supply; but in this case the amount of pollution that could come in was so small, and filtration was such a good mode of cleansing, that the danger was removed. The purity of the water depended on the efficiency of the water-works.

Justice ROMER remarked that the effect of this witness's evidence was that one could detect sewage contamination by chemical analysis; but whether such contamination was noxious or innocuous, chemical analysis could not show.

Sir R. E. WEBSTER (to witness): Is it not the fact that there may be danger in the water, and that chemical knowledge does not detect it?

Witness said it was not inconceivable that a small quantity of water flowing into a great body of water might be contaminated with typhoid or cholera germs, and that an analysis of a sample of the bulk might not reveal pollution. He could not say that the germ of poison might not be present in water, and remain undetected by chemical analysis; but it was reasonable to conclude that such germ was so minute as to be practically harmless. This was certainly the common-sense view of the matter.

In re-examination, witness said that germs of disease found their way into water by means of sewage; and sewage could be detected by chemical analysis. If there was no sewage present, he thought it reasonable to conclude that there were no germs of disease.

Dr. *W. R. Smith*, F.R.S.E., gave evidence which, in the main, corroborated that of Dr. Frankland. He said that he had examined the water bacteriologically as well as chemically; and the result was that he found no evidence whatever of sewage contamination. It was an absolutely safe water to drink.

Mr. NEVILLE cross-examined the witness at some length, with the view of showing the difficulty of ascertaining the nature of bacteria, and the effect their presence in minute quantities would have on people using for domestic purposes water which was not free from them. He said that sand filtration removed from water at least 75 per cent., and in some cases as much as 98 per cent., of the living organisms. He did not mean to suggest that sand filtration was markedly deadly to typhoid and cholera microbes; its action was favourless.

Mr. BALFOUR BROWNE said he had a large body of scientific evidence to the same effect as that already given; but he did not know if his Lordship would care to hear it.

Justice ROMER: No; I will give judgment. The plaintiffs in this action seek relief on the ground that the defendants have been supplying water polluted and dangerous to health. Few things are so important to a district as the supply of good water; and, personally, I should be inclined to take a very strong view as to the purity of the water required for drinking purposes. I am glad to ascertain, however, from the evidence in the case before me, that the defendants cannot be properly charged with supplying water in any way polluted or dangerous to health. The evidence adduced by the plaintiffs was, in itself, wholly insufficient to support the action. At most, it only raised a case of suspicion that some pollution might get into a part of the water forming one of the several sources from which the defendants get their supply; and that before it was filtered. No evidence was given as to pollution or bad quality of the water in fact supplied; and with that alone I am concerned. I might have dismissed the action on this ground; but, seeing the importance of the matter in the district, and the desirability of not allowing any suspicion to remain, if possible, I thought it right to let the defendants give me some evidence, as they were evidently anxious (and it appears to me rightly) to show that really there is no truth or sufficient ground for suspicion as to the purity of the water supplied by them. I am satisfied, on the evidence, not only that the plaintiffs' case fails, but that the defendants' water supply is remarkably pure—in fact, one of the best supplies in any district. One result of this action will be to satisfy the minds of the people in the locality as to their water supply; and perhaps, from this point of view, the costs of the action may not have been uselessly incurred. The action must be dismissed, and, of course, with costs.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Feb. 22.

(*Before Lord Justice* A. L. SMITH.)

Chapman v. South Metropolitan Gas Company.

At the close of the plaintiff's case, as given in the JOURNAL last week, that of the defendants was opened.

Mr. JELF, Q.C., said he regretted that public business had called Sir R. Webster to Paris; and it therefore devolved upon him to open the defendants' case. His Lordship could see how vitally important it was to the defendants, because, if such a claim as that made were not resisted, it would be impossible for them to carry on their works. Sir H. James had shown both the meekness of the dove and the wisdom of the serpent in his method of opening the case, and urged that there was no desire to stop the works, but only that they should be carried on more carefully. Unfortunately, it would be shown that no amount of care could prevent some quantity of sulphuretted hydrogen being given off; and, if any injunction were granted, the Company would be so inundated with claims that it would be impossible to carry on their undertaking, which in these works alone gave employment to 1398 men. The real question obviously was whether there was any sulphuretted hydrogen emitted from the sulphate-house, in addition to what was formerly given off from the gas-works. He put aside the question of the tarry substances, which was not pressed as of any importance. It was not a question of whether the steam acted as a carrying agent; for he should show that this was an obvious after-thought on the part of the plaintiff. The real case put forward originally was that sulphuretted hydrogen was given off from the sulphate-house. This, however, had passed the Government Inspector; and it would be proved that everything was in perfectly good order. But, of course, with regard to this matter, the Company were on the ordinary trade basis. The ammoniacal liquor was a residual product which was formerly sold; and if they manufactured it on their premises, they were under precisely the same obligations towards their neighbours as any other makers of sulphate of ammonia. So that, if it were proved that sulphuretted hydrogen was emitted from the house, this would be no defence to the action. It was a very different thing with regard to the ordinary manufacture of gas. When a gas company commenced operations, they had to give notice to everyone within a certain distance of the works, and compensation had to be paid in the ordinary way to those who were injuriously affected; and, so far as their works were there carried on properly, the Company were under statutory protection. Sir H. James had said that there was nothing in the Company's Act to authorize the committing of a nuisance. But subsequent Acts of Parliament had been passed which made it necessary to attain a certain degree of purity in the gas; and he should show, by the evidence of experts, that it was impossible to comply with the regulations of those later Acts without emitting some sulphuretted hydrogen. He did not say that science might not some day be able to deal with this difficulty; but as yet it had not done so. It could only be effected by lime purifiers; and, when they were used, a certain amount of sulphuretted hydrogen was inevitably given off, which, coming in contact with anything sensitive to its action, must produce more or less injury. That was the first legal defence to the action. The second was this: If the Company had for 20 years carried on the process of making gas in the same manner, and producing the same amount of sulphuretted hydrogen, as they did now, without change, this was an answer to the action. But, to return to his first point, the fight here was on the question whether or not this nuisance came from the sulphate-house.

His LORDSHIP asked if Mr. Jelf contended that, if there was no nuisance practically before 1891, and there was one since, the defendants were not liable.

Mr. JELF said it was agreed that the gist of the case was whether or not this great change took place at the end of 1891; and he desired to approach the question from his point of view. The plaintiff's case was that, as one approached nearer to the works, the damage became greater; that the sulphate-house was built at a certain time; and that things which were not noticed before became very visible soon after. If this were true, one would look to find on the other side of the canal something going on which would account for it; and this was why he asked to be allowed to approach the question from his point of view. He should demonstrate, first, that nothing came from the sulphate of ammonia works; and, secondly, he had to show that nothing more was done in, and that there was no further emission of sulphuretted hydrogen from, the gas-works proper, than there was before, and that therefore the case made out on the other side was an untrue one. The plaintiff's witnesses had gone altogether on a basis of theory which was false and mistaken; it being founded on an error or assumption on the part of Mr. Newton that the water which had been condensed at the last stage, or at the penultimate stage, of the process going on in the sulphate-house went into the tank. This he should show was an entire mistake. There was no such defect in the plant. The water was condensed in coolers, and none of it went into the tank; and therefore the bottom was cut away from Mr. Newton's theory. It was true he had suggested that difficulties might occur in other ways. But not one of the plaintiff's witnesses detected any leakage in the works; and it was not likely that the Company would allow such a

thing. Then he had also suggested that there was sulphuretted hydrogen in the tank water in the earlier process; but this was an utter fallacy, as would be shown by witnesses, and there was, in fact, no foundation for any suggestion of defect in the process carried on. But in the progress of the case, there was a remarkable change of front, which he suggested was in consequence of a consultation which took place after the cross-examination of Mr. Newton by his friend Sir Richard Webster; and a theory was then put forward which was possibly "in solution" in the mind of Mr. Attfield before, but was not "precipitated" till that part of the case was arrived at. That theory also would not stand the test of examination. He should show that, from the gas-works proper, there was no increase of sulphuretted hydrogen emitted since November, 1891; and when this was established, the evidence given on the part of the plaintiffs would have to be looked at from a different point of view. He should show that these witnesses were thoroughly mistaken as to the existence of the extraordinary change which was represented to have taken place in this district, which was described as being up to a certain time almost a paradise, but which afterwards became a veritable pandemonium. He should submit that this evidence could not stand. He did not suggest that any, or most, of the witnesses were not saying what they believed to be true; but he craved in aid his Lordship's knowledge of these questions, and of the easy way in which persons fall into the views of the side they represented, especially when they were interested. The obvious starting-point of all this evidence was the new sulphate-house. The neighbours talked together about it; and therefore it was not wonderful that there had been a body of evidence which very well held together. Still it was open to very strong comment in some parts. With regard to the date, which was the crucial point, one witness—Mr. Head—gave the origin of the mischief as 26 months ago. Of course, the case did not rest on his evidence alone; but that was a good illustration. A lady began to talk about November, and then changed it to December. Again, the large part which imagination played in this case was abundantly shown by several of the witnesses. Some of them thought that the steam-pipe had mitigated the effect; their idea being that it was put up to remedy the alleged nuisance. The fact, however, was that it had nothing to do with it, but was put up because the cloud of steam previously rising from the tank was found to be inconvenient and dangerous for the traffic passing by the side of the canal. Again, numbers of the witnesses spoke of the early morning as being the worst time—evidently thinking that some particular process was then carried on; but this showed that what was complained of could not come from the sulphate-house, because the work there was continuously carried on day and night. In fact, if there was any additional smell in the early morning, it must come from the purifiers. The real controversy on the facts would be as to whether this change came about in November, 1891; and, as regarded this, he should rely upon the well-known principle that one witness who saw a thing was worth twenty who did not see it. Many of them said they did not see it before, but could not swear that it did not exist; and it was only reasonable to suppose that, unless their attention was specially called to it, many of these things would pass without objection. He was instructed that the "blue mould" had been observable not only on this estate, but all about the gas-works, during the whole of the time. But, of course, this was not necessary to his case. The important point was that there had been no increase in the quantity of sulphuretted hydrogen produced. If his Lordship arrived at the conclusion that some amount of sulphuretted hydrogen had come from the works over the neighbouring land for some twenty years and more, the fact that it did not show itself until during the last ten years would not be material. He had never pretended that sulphuretted hydrogen did not come from the works. It was the common case that it did; but at the same time there were other causes which contributed to its production, which must all be taken into account. He believed he should be able to show that there were many places in London, where there were not any gas-works, which showed blue mould on the paint quite as bad as anything shown here. One remarkable instance was at Peter Robinson's, in Regent Street, of which he would produce photographs. The question here was entirely one of degree—of a certain time when it was alleged to occur, and whether any change then took place. He should call evidence to speak to the state of affairs adjacent to the gas-works, and not confined to the plaintiff's property, and to show that there was very great discoloration long before November, 1891. He was not in a position to prove that there was any special contribution of sulphuretted hydrogen from any other works in the neighbourhood. There were several such works; and evidence would be given about them. But with regard to the gas-works proper, it would be shown that nothing more could be done to prevent the nuisance; and, if this were so, he relied on the Act of Parliament. As to the theory of the steam being the carrying agent, it was perfectly absurd. That theory seemed to be that the steam coming from the pipe at that point gathered up all the impurities in the air, and carried them on to the plaintiff's property, and that this was an actionable nuisance. But he submitted that it was entirely unheard of. Supposing that, instead of the sulphate-house, the defendants had any other apparatus which gave off a quantity of steam. If they were not the owners of the adjoining gas-works, was it conceivable that any lawyer could get up and say that this would be a cause of action against the person who owned that steam-pipe, because there were other persons behind who were making gas, and that the action of the steam on what was produced at the gas-works caused the nuisance to the neighbours?

His LORDSHIP remarked that it was not at all clear that, if a man put up a steam-pipe which carried "blacks" from the chimneys on to his neighbour's land, it would not be an actionable nuisance.

Mr. JELF submitted that, though theoretically such a thing was possible, practically no such action could be successful. The blacks were there, and they must go somewhere; and the theory put forward would be that, whereas the "blacks," in a certain state of the wind, were spread over 300 houses, they were carried, through the action of a particular steam-pipe, when the wind was in a certain direction, on to 20 particular houses, though on other days they might be carried right away, or on to 20 other houses. He doubted whether such a cause of action would lie. However, it was not the cause of action they had come there to meet. If this had been so, the steam could be condensed, and possibly some arrangement of the kind might have been made; but this was altogether an after-thought, and an attempt to get out of the fact that the plaintiff had failed on the main issue of the case. Even apart from that, however, he thought it would be proved that the theory had no weight in it, because one witness said he perceived the smell before the steam came, although not so strongly. He (the learned Counsel) would put forward evidence of gentlemen who understood these things, and who would also show that equally bad effects could be produced in other parts of London, quite irrespective of the proximity of gas-works.

Mr. *G. Livesey* was then called. He said he had been Chairman of the defendant Company since 1885; having formerly been the Engineer and Secretary. He had been connected with the works since 1848; but he had known them since 1839, when his father, to whom he was afterwards assistant, went to reside on the premises. Gas making was commenced in 1833 by the Company, who were incorporated in 1842; and in 1869 they came under the legislation under which they now worked. There had been amendments with regard to gas testing—one being in 1880. They were bound to supply gas of a certain illuminating power and purity; testing-stations being established, and certain conditions imposed. An Act was passed in 1876, amending the 1869 Act, and introducing the sliding scale. Section 25 of the 1869 Act provided that the gas should be free from sulphuretted hydrogen. The quantity of ammonia and sulphur compounds other than sulphuretted hydrogen was fixed by the Gas Referees. [The regulations were read and put in.] Fresh regulations were issued every six months. The amount of sulphur compounds permitted was less in summer than in winter. By the use of oxide of iron purifiers, gas could be wholly freed from sulphuretted hydrogen; but lime was necessary to get rid of the other sulphur compounds. There were no other known means of removing sulphur compounds. [The witness then described the method of purifying gas by lime; pointing out that the fresh lime had no affinity for the sulphur compounds.] It formerly took a day to empty and refill a purifier; but it was now done in a little more than half a day. The foul lime was run into barges, and immediately covered with ashes or earth. Except in cases of emergency, this operation was begun at five o'clock in the morning. Some few years ago, four purifiers instead of three were used in each set. Since the plaintiff's houses were erected, much more care had been exercised in dealing with the refuse lime; a barge being always kept waiting to receive it. The smell of "blue billy" was mainly sulphuretted hydrogen, though mixed with other compounds. Sulphuretted hydrogen was given off during the removal of the refuse lime; and, in smaller quantities, in quenching the coke, and also from the ammoniacal liquor. Each ton of coals carbonized yielded from 20 to 30 gallons of liquor, which was water containing ammonia combined with sulphuretted hydrogen. Very little of the latter escaped from this source into the air at present. It was conveyed into underground tanks, and was pumped out of them at intervals. The tanks were covered; but it was necessary to put in ventilating-pipes to prevent the collection of an explosive mixture. These tanks had always been in use. The Company formerly sold the liquor to manufacturers of sulphate of ammonia or artificial manure. No sulphuretted hydrogen in any appreciable quantity escaped into the air from any other source. When a purifier had to be changed, it was full of foul gas, which was now drawn out by an exhauster before taking off the cover; but of old it was allowed to escape into the air. This change was made some years ago; and it prevented a considerable emission of sulphuretted hydrogen. He had made many experiments with the idea of purifying gas in permanently closed vessels, but had always failed. The method of purification employed by the Company was the only practicable one. They sold their ammoniacal liquor up to the starting of the sulphate-house. When so sold, it was pumped up into elevated closed tanks, and then run through pipes into barges brought alongside the works. There was a perceptible escape of sulphuretted hydrogen from this liquor as it flowed into the barges; and it could be smelt on the opposite side of the canal. Since November, 1891, the sale had been discontinued in favour of the manufacture of sulphate of ammonia. In his opinion, the alteration had diminished the quantity of sulphuretted hydrogen given off by the loading of the barges. Sulphate was used for manure. The pipes by which the gases were conducted in the manufacturing process were as tight as they could be made—perfectly so, he believed. He could not describe the process better than by referring to Mr. Newton's account of it. The ammoniacal liquor entered at the top of a Coffey still, and steam at the bottom. At 212° Fahr. the liquor parted with its volatile constituents—ammonia, sulphuretted hydrogen, and carbonic acid—but still retained a little ammonia combined with acid, termed "fixed salts." In the lower part of the still there was an arrangement for introducing milk of lime, which mingled with the acid and let the ammonia pass on. The milk of lime, with the acid combined with it, and with the now innocuous water from the ammoniacal liquor, went into the tank by the side of the house about which so much had been said. The gases driven off passed from the top of the still into the saturator, into which flowed sulphuric acid, which fixed the ammonia, and allowed the carbonic acid and sulphuretted hydrogen to go on. The sulphate formed as a salt; and it was continually drawn out and set aside to drain. The remaining gases went first through a vessel, to arrest any acid which might have gone over, and then, accompanied by a good volume of steam, passed into a 12-inch pipe condenser, in which the steam condensed, and carried a large quantity of sulphuretted hydrogen with it to the bottom of the apparatus. Thence this foul liquor was conveyed by a sealed pipe into the liquor-tanks underground. It was only a small amount in comparison with the ammoniacal liquor. The gases which went forward—the carbonic acid and the sulphuretted hydrogen—passed through a Claus kiln, where, by the admission of a certain quantity of air going with it into a heated chamber, a portion of the sulphur was burned into sulphurous acid. The mixture then went on to depositing chambers. He would rather not pin himself to the exact chemical reactions which took place; but he would say that there the sulphur was deposited in the solid form. It was difficult, if not impossible, to exactly adjust the supply of air. If there was too much, there was an

excess of sulphurous acid in the chambers; if too little, there was an excess of sulphuretted hydrogen. Provision was made for both cases. The gases went first through a vessel containing limestone or chalk, to catch any sulphurous acid; and to arrest any excess of sulphuretted hydrogen, the gases were sent through oxide of iron purifiers, which absorbed any which might have passed the kiln, and the carbonic acid then escaped into the air. There were from 3 to 4 feet of oxide of iron. The effect of the process was to remove all the sulphuretted hydrogen—all but a mere trace being converted into solid sulphur; and the oxide of iron arrested that trace if it was there. All the vessels were sealed; and, in the ordinary course of work, it was impossible for an escape to take place. If it did, it would be instantly detected by the smell. The ammoniacal liquor was stored in the same receptacles as before the manufacture commenced. There was a ventilating-pipe to the tank at the top of the sulphate-house, through which some sulphuretted hydrogen might be given off. It was quite a small pipe; and no appreciable quantity of sulphuretted hydrogen could escape from it, or ammonia would be lost. There was less sulphuretted hydrogen given off from the works than there was ten years ago; for, as houses had increased, the Company had constantly adopted additional means to prevent its escape. They probably arrived at the maximum improvement four or five years ago. Since then the quantity emitted had certainly not increased. Twenty years ago there was no need to trouble about the matter; and though there was not so much gas made then as now, there was probably as much sulphuretted hydrogen thrown out. All the houses in the neighbourhood had been built within his recollection. He could not say where the ventilating-pipes to the liquor-tanks opened into. Last year there were explosions at Nottingham and Bradford through such tanks not having proper ventilation. He remembered the City of London Gas-Works, near the Temple. At one time lime was used for purifying; but it was given up when Mr. Hills invented the oxide of iron system of purification, which rendered lime unnecessary, because the chemists had not then discovered the other sulphur compounds. Lead paint always more or less discoloured in the neighbourhood of gas-works. The appearance of the doors exhibited was quite familiar to him. Some 40 or 50 years ago the same complaints were made; and zinc paint was then discovered, and recommended for use in such places. It seemed to him that the discolouration had always been the same. He did not wish to doubt the statements of the witnesses who spoke to noticing an increase in December, 1891; but he did not see it. His explanation of the increase, if it had occurred, was that there was no additional emission of sulphuretted hydrogen whatever, but that the atmospheric conditions at the time were, in his experience of 40 years, perfectly exceptional. He had been a great observer of fogs, as they caused great anxiety to gas makers; and up to that time, he had never known a fog to last more than three days. On this occasion, however, there were fogs lasting from the 19th to the 24th of December. For the first time in his experience, the gasholders were empty. They were pushing the works to their maximum power to supply the demand; and, there being no wind, the sulphuretted hydrogen given off in the ordinary course of gas making was not carried away. The moisture added to the effect. Lead test-papers were inconceivably sensitive to sulphuretted hydrogen. He had seen discolouration in other parts of London; but he had not gone about looking for it. He had noticed it in Parliament Street, on the pilaster of the door.

Cross-examined by Sir H. JAMES: His attention had been devoted to these works all his life. His brother was the Engineer. They were obliged to use lime to reduce the sulphur compounds. Counsel read a section of the Act, and asked if the works had been conducted under the impression that the Company were not responsible for a nuisance. Witness said he could not answer questions of law. He did not claim any right to cause a nuisance. He did not consider that the defendants created a nuisance. If such a thing were to be deemed a nuisance, it would shut up every works in London. It had discoloured paint and caused a smell; but he could not say whether this was or was not a nuisance—not injurious to health. He would not say there might not be a nuisance from damage to property without injury to health. He had been on the plaintiff's property before 1891; but he could not say when. He had been through the district lately, and had looked at the houses. He had not had any report made. He could not say what was the number of houses affected; he should think less than hundreds. He could not say how many he saw injured before 1891; nor could he name any one in particular. Paint was always discoloured in the neighbourhood of gas-works. He could not say anything definite as to the discoloration on the plaintiff's property prior to December, 1891. He had no doubt he had seen it, but did not particularly notice it. He could not give a specific instance of any house being injured. There was a great deal of difference between seeing and noticing. He passed people in the street, and saw them; but he did not notice them. He had no doubt smelt sulphuretted hydrogen on the plaintiff's property—the smell from the purifiers, which was principally sulphuretted hydrogen. He had also smelt sulphuretted hydrogen itself. The odour was perceptible when the wind came from the gas-works. The smell was not objectionable to him; but it would probably be considered to be so by persons not accustomed to it. This referred to a time prior to 1891. He could not say he recollected any occasion on which he had smelt it on the plaintiff's property since December in that year. It could be smelt when the wind was in the right direction whenever the purifiers were open. He did not wish to doubt the statement of the witnesses that the time they noticed an increase was about December, 1891. He did not attribute all the effects during 1892 to the fog that lasted from the 19th to the 24th of December. Sulphuretted hydrogen existed before 1892, although the witnesses had not perceived it. He did not doubt that the blue on the door exhibited was produced by sulphuretted hydrogen. The fog intensified the injury. When there was a fog, there was no wind to carry away the fumes from the purifiers, and mix them with a large quantity of air. When the fumes were held in the fog, they were in a condition by which paint was much more readily affected than in a dry atmosphere. This was on account of the humidity of the fog. The steam from the pipe, if it came in contact with the sulphur from a purifier, might intensify the effect upon lead paint. The blackening of the brass frames of the photographs produced might have been caused by the fumes from gas-works. This blackening was not pleasant; but it was one of the penalties people suffered from living in London. In the depth of winter, the Company made from 25,000 to 30,000 gallons of ammoniacal liquor at the works in question; and it was worked up as quickly as possible. The average monthly production of sulphate of ammonia was about 230 tons.

Sir H. JAMES: If you do not doubt the fact that, at the date spoken to by the witnesses, there was an increase of injury to their premises, and that they perceived smells, and admitting that the steam action may intensify the injury, are you prepared to say that the steam action did not intensify the injury which the witnesses have spoken of?

Witness: I say deliberately the steam action had nothing to do with this injury.

So far as the steam went over the plaintiff's property, would not that steam intensify the action of the sulphuretted hydrogen on the paint?—Yes, to some slight extent.

Cross-examination continued: Sulphuretted hydrogen would not cause the smell to be more disagreeable. The smell of gas-works never made a child ill. Sulphuretted hydrogen, in sufficient quantities, would injure health. One part of sulphuretted hydrogen in 800 parts of air would destroy life; but one part in 100 millions would discolour lead paper, though it was utterly innocuous. Hundreds of children suffering from whooping cough were sent to gas-works by doctors to inhale the fumes from the purifiers. It was a coincidence that there was more illness among children after December, 1891, than before. Asked what had been the increase in the quantity of gas produced at the Company's works during the last six years, witness said he would give it in the quantity of coal consumed, omitting hundreds. In 1886 it was 171,000 tons; in 1887, 177,000 tons; in 1888, 166,000 tons; in 1889, 180,000 tons; in 1890, 187,000 tons; in 1891, 176,000 tons; and in 1892, 182,000 tons. The more gas there was produced, the more sulphuretted hydrogen would go into the air, other things being equal. The quantity of sulphuretted hydrogen going into the air did not depend on the amount of coal used. Some coal was more sulphurous than other. The greater part of the sulphuretted hydrogen was thrown off from the purifiers when they were opened. There had been no change in the quality of coal employed during all these years. The Company had been fined for having too much sulphur in their gas. This was due to using coal which did not contain enough sulphuretted hydrogen. If the oxide of iron purifiers were defective, the carbonic acid gas would go into the air with the sulphuretted hydrogen. In all neighbourhoods adjoining gas-works discoloration of paint was usual; and persons should employ zinc paint that would not discolor. The main discoloration to the plaintiff's premises was from the gas-works.

Re-examined by Mr. JELF: He had not gone over this estate to count the number of doors discoloured. The Company were convicted in the present year for supplying bad gas in August from the Greenwich works. The defect arose in consequence of a strike. The Company had to supply gas, but they could not get the usual quality of coal. About 180,000 tons were used each year at the works in question. The humidity caused by the steam from the pipe bore no comparison to that caused by fog. Sulphuretted hydrogen passed through the sulphate-house in sealed pipes; but there was no leak from them. There was no possibility of escape of sulphuretted hydrogen from the house.

Robert Underwood, of 45, Delaford Road, and formerly of 70, Barkworth Road, said he had always noticed smells from the gas-works, but could not say they had recently become worse. The paint on the doors in Barkworth Road was discoloured when he went there seven years ago. He had been in the police force for 26 years; being pensioned off in October, 1890. He had patrolled the streets in question for more than six years, and had noticed the paint on the houses discoloured in certain roads. He had seen the same thing in other parts of London.

Cross-examined: He would not say that he had seen any doors discoloured to the same extent as those produced in Court. He had noticed very little increase of late.

Mr. *R. Rapkin*, of 303, Linton Road, Bermondsey, formerly in the police force, having retired in 1883, said he knew the Bermondsey Estate, and had seen the discoloration of the paint. Ten or twelve years ago he had noticed it, more or less, on the doors and window sashes. It was similar to the discoloration on the doors in Court, but not so bad. He could not say when the different streets were finished. He had noticed very offensive smells from the gas-works from time to time, going back 20 or 30 years. The property was certainly very bad now—worse than it was. On his own door there were marks; and a few doors off it was much worse. This was three-quarters of a mile from the works. He had seen it in Rotherhithe and other places, including Tooley Street.

Thursday, Feb. 23.

This morning Mr. *Rapkin* was cross-examined. He said he retired from the police force in 1883; and that before that year he saw markings on the houses at the top end of the Rotherhithe New Road. He had seen them in Barkworth Road, Verney Road, and very bad in Varcoe Road. He lived in the Lynton Road; and the panels of his door were marked.

Dr. *A. W. Ward*, Medical Officer of Health for Camberwell, said he attended patients in the district in question. He had had private patients for about nine years, and had never met with any case of illness which he could attribute to emanations from the gas-works. There were smells which were sometimes offensive. He had noticed upon the houses in Verney Road, Barkworth Road, and Varcoe Road, a greyish discoloration of the paint, produced by the gas fumes. He had also observed it in Delaford Road, and all round the Rotherhithe New Road. He should not call it a substantial discoloration—the patches being only about the same size as a half-crown; and he had not noticed that they were increasing at all. He had many times perceived offensive smells in the Verney Road; but he did not attribute them to the gas-works. The smell was like decaying organic matter, and might come from a glue factory, or something of that sort.

Cross-examined: He had been asking one or two other doctors to come and give evidence for the defendants with reference to the nuisance complained of. He first heard of the litigation in March last,

when he made an affidavit for the Company. He had requested Dr. Cooper to give evidence on their behalf. He had smelt sulphuretted hydrogen in the neighbourhood of the gas-works. It had an offensive odour; and if a man took a mouthful of it, it would be likely to make him feel sick and nauseous.

Mr. *Reuben Kilbey* said he was a builder, and had formerly been employed on the South Bermondsey Estate. He had done work in every street on the plaintiff's estate, and had noticed discoloration on the houses. It was as though a person had taken a black-lead brush, with a little black-lead or bluish tint, and touched it in patches over the woodwork. The mischief slightly increased as the years went on. In the Ilderton Road, and in part of the Bramcote and Cranswick Roads, there were some better class tenants, who used to keep the places clean, and the discoloration would not be noticed.

Cross-examined: He had not worked on the estate since 1888. He had often perceived a tarry smell. It was a general complaint made; and he did not think any person on the estate could conscientiously say he had not smelt it. He was not personally interested in finding out what the offensive smells came from. They might arise from glue factories, manure works, fat melters, &c.

Mr. *T. B. Bristow*, boot and shoe manufacturer, of 187, Galley Wall Road, South Bermondsey, said he had lived at this address for ten years. He knew the Credon and Varcoe Roads very well, and had noticed discoloration of the paint on the houses. It had become worse on account of the paint getting older. He should attribute a great part of the offensive smells to the glue factory and soap works.

Mr. *J. W. Rattenbury*, a house and estate agent, Mr. *Norman London*, a shipping clerk, and Mr. *H. Child*, a chemist and druggist, gave similar evidence.

Mr. *H. Thomas*, Sanitary Inspector to the Bermondsey Vestry, said he had three houses in Egan Street, two in Delaford Road, and six in Milledge Street. They were painted about five years ago; and six or eight months afterwards, patches of a dark colour came on the paint. It had been gradually getting worse ever since. He should not attribute it to fog.

Mr. *R. Boulden*, a painter, stated that from 1887 to 1889 he lived at No. 109, Verney Road. He noticed the discoloration of the paint when he first went into the house. As time passed on, the patches became rather larger and more "polishy" in appearance. When he left the house in 1889, there were more patches; and they were much more extensive. He went through the Verney Road in January; and the patches were worse then than they were in 1889. No one connected with the Company had ever asked him to go and see the present condition of the houses. He had never had any cause of complaint of injury to gilt frames or brass work.

Mr. *George Livesey* was here recalled, and said that the practice of putting "blue billy" on the bank of the canal was discontinued gradually as the houses came to be built. Ten years ago, he should say, they discontinued storing the lime on the bank. He had ascertained that up to five years back there was occasionally a little put on the bank to wait for a barge, but none since then.

Dr. *P. R. Crofton*, a physician living at 37, Bonina Road, South Bermondsey, said he had patients in the different roads on the estate. He first began to practise there in October, 1891. In his judgment, the smells spoken of were not deleterious to health; and he had never, from October, 1891, down to the present time, had any case of illness attributable to this cause. He knew the odour of sulphuretted hydrogen, and had perceived it on the estate. It was slightly injurious to health; but it depended upon the quantity given off. The weaker the person, the greater the effect. He had heard and read of children being subjected to the fumes of sulphur for whooping cough. There was sulphuretted hydrogen in it; but he should not consider it deleterious, but beneficial in that case. The injury to health depended on the quantity.

Mr. *W. Powell* said that he lived at 4, Milledge Street, and was the owner of two houses there. He bought the property about seven years ago. He found on the paint patches resembling a kind of oily tar. It was shiny in damp weather; and in dry weather it became of a dull leaden colour. Before he took the property, it was painted; but within twelve months streaks came out on the stonework—the same sort of blue discoloration there had been before. The houses had been painted three times during the last seven years. After the second painting, there was the same discoloration; but he had not noticed it since the third painting, in July last.

Similar evidence was then given by several other witnesses.

Friday, Feb. 24.

George Bradley, employed at the soap-works belonging to Messrs. Sowerby, said that for the last nine years he had perceived a smell which made one sick, together with black smoke, which came from the works of Messrs. Dussek, adjoining the soap-works. For the last 20 years, he had perceived smells from the gas-works; but they were never offensive. Since Dussek's works were burnt down last November, he had not detected the offensive smell to which he referred.

Cross-examined: He thought there had not been any increase in the smell since November, 1891.

Mr. *T. H. Sowerby* said he had been employed at the soap-works for the last six years, during which time he had perceived a rank, sour smell which came from Dussek's works. He did not think the smell had been perceptible since the fire last November.

Cross-examined: The smell from the gas-works was suggestive of sulphur; that from Dussek's works was more like bone oil.

Mr. *H. Glendinning*, who resides on the estate in question, said that he had perceived a smell from the gas-works, but only within about the last 15 months.

Cross-examined: His wife had recently called his attention to the decoration of the house being affected by some chemicals. This was about six months ago. The paint had turned a bluish-black colour.

James Austin said he worked at Messrs. Dussek's three years ago. They used to distil bone oil. This smelt of everything that was putrified, and had frequently made him vomit. He never perceived any smell from the gas-works, because their own smells took all of them away.

Francis Groome, formerly a workman at Dussek's, substantially corroborated the previous witness.

Mr. *H. Dinwiddy*, Fellow of the Institution of Surveyors, said he had been over the plaintiff's property with the view of seeing the extent of discoloration existing upon it. A good many of the houses had gone twice the usual time without being painted. Where the paint had been fairly well preserved, in consequence of the owners being more careful of their property, there were no stains to be found. It was only where the paint was old and neglected that the stains seemed to fasten. It was quite easy to wash off the stains. He was familiar with the blue discoloration in other parts of London, particularly on the old Surrey Gardens Estate at Walworth. He attributed this condition of things on that estate to the fact of its being a damp site, the same as the property in question in the present case.

Cross-examined: He thought the gas-works were not the cause of the stains. Witness was shown a stained piece of wood, taken from the Verney Road; and he admitted that the discoloration must be due to other than atmospheric causes—possibly the gas-works and other factories.

Mr. *C. Barker*, Surveyor to the Duchy of Cornwall, said that he had examined the estate for the purposes of the present proceedings. He found that the discoloration of the paint was irregular; it was very marked near the gas-works corner, and also at the Ilderton Road. Witness was questioned at some length as to the result of his examination of various parts of the estate; and he said that, generally speaking, it was in a dilapidated and dirty condition.

Cross-examined: He should think the injury to the plaintiff's property was caused by sulphuretted hydrogen; but he thought the atmosphere had something to do with it, and also the humidity arising from the canal. Half the houses at least on the estate were affected; and the injury unquestionably became worse as the gas-works were approached. He was of opinion that the traces of the fumes could be washed off with soap and water, even if they had been affecting the paint for five months.

Re-examined: There were discolorations on woodwork at Poplar, near the gas-works, as bad as those on the doors exhibited in court. Witness then gave several other instances of places in London where he had seen similar discoloration.

Mr. *Frank Livesey* was the next witness. He said he had been Chief Engineer of the defendant Company for upwards of ten years; and from 1873 to 1883, he was Assistant-Engineer. In the manufacture of gas, even in the best-conducted works, it was not possible to avoid from time to time the emission of sulphuretted hydrogen, especially when lime was used for purifying. During the last four or five years, the spent lime had been conveyed direct to a barge, and covered over with earth or ashes, instead of being left in heaps on the works. The men came at six o'clock in the morning, and began immediately to empty the purifiers; and the foul lime was invariably all got out by nine or ten o'clock. There were 16 purifiers at the Old Kent Road. In winter time the purifiers were cleaned out four or five times a week; and, if the wind happened to be blowing from the gas-works in the direction of the plaintiff's estate when this work was being done, there was no doubt that the smell of the sulphuretted hydrogen did go across it. If they used red lead paint near the purifiers, it would be discoloured in a week. The gasholder columns were painted with oxide paint, and were not in the least discoloured. He could remember the blue discoloration that had been referred to in Ruby Street and Caroline Street for more than 22 years. Asked whether he wished to supplement the statement made by his brother with reference to the ventilating-pipes, witness said that, when his brother was Engineer of the Company, he ventilated the liquor-tanks; but he (witness) had altered this system—stopping all ventilation, and preferring to incur what he considered to be a slight risk of explosion. He made the alteration about ten years ago. The tank of the sulphate-house had been closed from the time of its erection, and had never been ventilated. He had been about the sulphate of ammonia works nearly every day. There had never been any leaks in the pipes or in the apparatus. In April and August of last year, there had been a slight stoppage in the pipes, and for about a quarter of an hour there would be an escape of sulphuretted hydrogen. With these exceptions, there had been no leak from the sulphate-works since they had been in operation. The liquor coming from the condenser of those works, which was a very offensive liquor, ran into a sealed tank, known as the "scrubber-well." The sulphuretted hydrogen could be controlled better in the sulphate-works than in any other part—in fact, it could be stopped there. With the exception of the two instances he had mentioned, no sulphuretted hydrogen had escaped from the sulphate works. The steam-pipe, which was 18 inches in diameter and about 35 feet long, was erected because he thought the steam from the tank would be dangerous to the horses. There was no sulphuretted hydrogen in the steam which came from the tank. There was some smell from the steam; but it was not sulphuretted hydrogen. The steam had certainly not increased the nuisance of sulphuretted hydrogen (if there was any) from the defendants' works. The coke was quenched by water continuously, during the day and night, except on Sundays; and sometimes this operation developed sulphuretted hydrogen. He had been over the plaintiff's estate since the commencement of these proceedings. There was no doubt about the blue discoloration referred to. The fog that was experienced at Christmas, 1891, was exceptional, on account of its long continuance.

Cross-examined: He attributed the injuries in Ruby Street to the gas-works; but he had never heard of any complaint in respect of them. The first complaint they had was about two months after the sulphate-house was started. He visited the estate about a month afterwards, and found the houses in the condition in which he would have expected to find them; and he attributed the injury to them mainly to the gas-works, and certainly to the London fogs, which distinctly caused the discoloration apart from the gas-works. The fog certainly intensified the effect of the sulphuretted hydrogen. That which acted upon the plaintiff's property came partly from the atmosphere and partly from the gas-works. It got into the atmosphere from every fire that was burning. He had never heard of any complaint prior to November, 1891. When he first visited the property, it was badly discoloured. On his next visit, in the autumn, it was distinctly better.

In January of this year, however, after there had been fogs, it was worse again. Every damp fog would discolour paint.

Saturday, Feb. 25.

Mr. *Frank Livesey*, in further cross-examination this morning, said the sulphate-house was hardly capable of dealing with the maximum quantity of ammoniacal liquor produced in the manufacture of gas in the winter; so that some of it had to be stored, and worked up in the summer. Work was carried on in the sulphate-house night and day in the winter; but it was stopped for a month or two in the summer, when the stock was all worked up.

Re-examined: It was the sulphur in the sulphuretted hydrogen that affected the paint. The ammoniacal liquor was pumped into a tank which fed both the kilns in the sulphate-house. The atmosphere above the liquor in this tank was saturated with sulphuretted hydrogen and ammonia; but it could not possibly escape, because the tank was covered by a grooved and tongued wooden cover.

Dr. *W. Odling*, F.R.S., was next called. He said he had known the defendants' works for about 30 or 40 years; and he had visited them on two occasions recently—the end of September and the beginning of December, 1892—with reference to the present action. There were no leaks from the pipes; and there was no smell of sulphuretted hydrogen. Had there been, he must have detected it, as he had test-papers fastened on his coat the whole time, besides others that he used specially. He denied that the pipe for the waste steam could carry off sulphuretted hydrogen with it from the works. The steam conveyed by the shaft referred to did not contain, and was not liable to contain, sulphuretted hydrogen. It was not possible that the steam would attract to it or become the vehicle of sulphuretted hydrogen from the atmosphere, either in a concentrated or a non-concentrated shape. With reference to the following answer given by Dr. Attfield —viz., "Even though the steam from the end of the shaft be free from sulphuretted hydrogen, yet it will, by a law of Nature, dissolve any sulphuretted hydrogen whatever that may be in the air of the works through which it passes, and will carry that sulphuretted hydrogen in concentrated form to paintwork; for a given bulk of water will dissolve three times its bulk of sulphuretted hydrogen gas, and when this water is in the form of steam, it is in the most fit condition for thus dissolving sulphuretted hydrogen"—witness maintained that it was entirely incorrect; there was no such "law of Nature." So far from the steam taking up and concentrating sulphuretted hydrogen out of the air, supposing the steam to be charged with sulphuretted hydrogen, the air would take it out of the steam. London fogs contained sulphur which acted on the lead in paint, and caused discoloration. There was no doubt that a fog in the neighbourhood of a gas-works was more charged with sulphurous compounds than fogs elsewhere; and especially from the circumstance that during fogs there was special pressure put upon the works by reason of the demand for gas. The sulphur carried by a London fog would have an effect upon silver plate, apart from the presence of gas-works. The emission of sulphuretted hydrogen when the lime in the purifiers was changed could not be avoided. When the purifiers were being cleared out, if the wind were in a favourable direction, sulphuretted hydrogen would be carried across the canal to the plaintiff's property. He had known of the blue discoloration spoken to in connection with gas-works for upwards of 40 years. When he first had to make inspections of gas-works for the Home Office, the purification was almost entirely by means of lime; and it was the commonest thing possible to see paint in the condition referred to. Then gradually, partly by pressure brought to bear by himself, the purification of gas from its sulphur compounds by means of lime was almost abandoned for the oxide of iron process. At this time the discoloration of paint by gas-works in a great measure ceased. Subsequently, a demand was put upon the companies to supply gas of greater purity in respect to sulphur compounds other than sulphuretted hydrogen, in consequence of which they had to go back to the lime process; the result being that the discoloration of paint had again become general. The oxide of iron was sufficient to take up all the sulphuretted hydrogen; it was the extra purification from the other sulphur compounds that necessitated the use of lime. There was no doubt that sulphuretted hydrogen was more active in a damp atmosphere than in a dry one; and the atmosphere of the neighbourhood in question was for nine months of the year saturated with moisture.

Cross-examined: The action of sulphuretted hydrogen on lead paint would be intensified by the presence of steam. He should expect to find increased effects from the sulphuretted hydrogen during such a fog as was experienced before Christmas, 1891. The amount of evident injury in the present case was greater than was usually to be found round gas-works in the present day.

Sir *F. Bramwell*, F.R.S., said he had no doubt that, if the wind were setting from the gas-works in the direction of the houses in the Varcoe Road when the purifiers were being cleaned, there would be a smell of sulphuretted hydrogen in those houses. He had examined the sulphate-house, and could not believe that, if everything were in order, sulphuretted hydrogen could be given off. He considered that the liquor-tank was closed in a proper way to prevent the escape of sulphuretted hydrogen into the air. If there had been any leaks in the pipes at the time he made his examination, he could not have failed to observe them.

Cross-examined: He had seen houses in various parts of London where the painted stucco in the areas was discoloured. He attributed this to the presence of an untrapped gulley, from which sulphuretted hydrogen was proceeding.

Mr. *F. N. Sutton*, F.I.C., one of the Sub-Inspectors under the Alkali Act, said the defendants' sulphate of ammonia works were erected so as to comply with the provisions of the statute, and were in every respect conducted on the most approved principle, so far as at present known, for the manufacture of sulphate of ammonia. He was at the works last in December, 1892, and found the plant in perfectly sound order, and the purifiers in a proper condition. It had been his practice, when he visited the works, to test for sulphuretted hydrogen—first by the sense of smell; then by the appearance of the oxide in the purifier; and, lastly, by test-papers. But he had never discovered its presence. His visits were made quite irregularly, and without previous notice. At the end of the process, there was only one means of escape for the gases produced, and that was by the oxide purifier. He had frequently tested that, but had never found an escape of sulphuretted hydrogen from it.

Cross-examined: The primary object of his visits of inspection was to see that the sulphate of ammonia plant did not cause any nuisance, offence, or damage to the public.

Monday, Feb. 27.

On the resumption of the hearing of the case this morning,

Lord Justice SMITH said that, since the Court rose on Saturday, he had been to see the place in question. He went over the estate and through the neighbourhood, and also over Sturgeon Road—a place in the old Surrey Gardens. He had no observation to make upon that. There was one thing, however, that struck him. He went into Uden's Yard, and looked over the railing, and he could see the vapour and steam going from the top of the tunnel; but he also noticed there was a considerable amount of steam coming out of about the centre of the east side of the sulphate-house, evidently under pressure. He had not heard a word about this.

Sir R. E. WEBSTER said he was very glad to hear that his Lordship had been to see the place. Quite independently of this, he was going to state that, if there was any idea at all of the 18-inch steam-pipe doing any harm, the Company would be very pleased to condense the steam. They did not admit that there was anything wrong; but they would condense it at once. With regard to the other pipe, he had not heard anything about it.

His LORDSHIP asked why it was that no evidence had been given in reference to the other pipe.

Sir R. E. WEBSTER said he was told that it was a steam-pipe used in connection with pumping in the lime.

His LORDSHIP said the importance of it was this—that Sir F. Bramwell's evidence was mainly based upon the quantity coming out of the tunnel, and that the steam was not under pressure; but, upon going down to the place, he saw a considerable amount of steam coming out under pressure. He should like some evidence about this pipe.

Sir R. E. WEBSTER said he would recall Mr. Frank Livesey.

Mr. *Frank Livesey*, recalled, said the steam came from a small steam-pump, which pumped the lime into the still. It came out under pressure. The pump was going all the time the apparatus was at work —night and day. The engine was only ½-horse power. The steam came from the pipe at a level of perhaps 8 feet from the ground. The pipe was not there when the sulphate-house was erected; it had only been there for about six months. The Company used to do this work with an injector, which did not cause any steam. The injector got out of order. It depended upon the condition of the atmosphere—whether there was any wind—how far steam would travel. He should say it would not travel more than 10 feet.

Cross-examined: The natural tendency would be for the steam to ascend; and, in ascending, of course it became mingled with the atmosphere. The diameter of the pipe was about an inch. The steam was driven out under pressure. He was present when Sir. F. Bramwell mentioned that the steam had no pressure behind it; but he quite forgot then that this pipe existed. Until he came into Court, he did not know that there was any damage whatever from the steam. There was no sulphuretted hydrogen coming from the pipe. The Company made 2000 tons of sulphate of ammonia a year.

Mr. *Corbet Woodall*, in reply to Mr. JELF, said he had visited the works of the defendant Company, and examined the premises in the neighbourhood. Looking to the requirements of the statute, and those laid down by the Gas Referees, he could not suggest any improvements in the manner in which purification was carried on. It was impossible for sulphuretted hydrogen to be given off by the process now in use, assuming ordinary care. Accidents were within the range of possibility; but, with ordinary care in the conduct of the manufacture, there was no danger. He was sure the apparatus did not send out, in the usual process of manufacture, any sulphuretted hydrogen. He had been to the top of the tank supplying the sulphate-house, in order to see whether it was opened or covered. He found that it was covered; and there was no escape whatever, or smell from it. He wished to emphasize the observations made by Dr. Odling as to the steam from the shaft of the tank—that it was not steam at all, but simply the vapour of water.

His LORDSHIP remarked that some people would call that vapour steam.

Witness: Vapour of water, I think, would be better. Steam is a vapour.

Examination continued: Steam itself was practically invisible; it could only be seen when it began to condense out. The steam would have some slight effect, when combined with sulphuretted hydrogen in the air, in hastening discoloration of paint; but it would not be more than that of a drizzly rain—in fact, he should think it would have much less. He did not believe for a moment that there would be any accentuated mischief from the sulphuretted hydrogen in consequence of the existence of the steam-shaft. There were at the gas-works from 10 to 15 non-condensing pumps and engines that gave off steam into the air day by day; and, adjoining the works, there were saw-mills throwing off a considerable quantity of steam from their engines. There were other works round about which also gave off steam, to which the contribution from the defendants' shaft was a most minute one. The amount of steam from their works must have been for many years of a constant quantity. He had noticed discoloration in the works. On all gas-works there was a certain amount of discoloration; but it was not noticeable where the paint was washed and attended to. Lead paint was not used in gas-works, as a rule. There was certainly a considerable amount of discoloration on many of the houses belonging to the plaintiff; but, having regard to what he had already said, he did not consider there was more than would be expected on houses in the proximity of gas-works. In fact, he might say emphatically that there was not more, because he did not think he had any experience of a place that had been, as it were, deliberately prepared to show the worst possible phase as this had been.

Lord Justice SMITH: Did you ever see anywhere a place as bad as Credon Road?

Witness: I do not think I have; but I have seen places very nearly as bad, where they have not been carefully and properly attended to. Take, for instance, the property about Lupus Street and in Bessborough Gardens, by the foot of Tachbrook Street. The property there is very much better than this; and it has been painted with greater regularity. I have no doubt that property of that nature has been attended to with greater regularity than we have heard this property has been.

Examination continued: The property in question in the present case was in a situation which appeared to require a special amount of attention to cleaning and painting; and they had been told that for 18 months it had been left uncleaned, and the painting had been at very long intervals. Supposing the property had been attended to and regularly painted and cleaned, he saw no reason why it should not compare favourably with other places in the neighbourhood of gas-works. Supposing a fine day, and the wind coming along with the sulphuretted hydrogen on to the plaintiff's property, he thought the steam would have effect, but it would be of the most infinitesimal character; a drizzly rain would have considerably more. A fog would have a still worse effect, as it would tend to keep the sulphuretted hydrogen down. Brasswork in houses far away from gas-works became discoloured comparatively quickly in the atmosphere of London. In his own house at Hampstead Hill, he had noticed a fastener on the window which was very much discoloured. That fastener he now produced. His own house was not near any gas-works.

Cross-examined: He had been employed professionally by the defendant Company, the same as he had been by many other companies, as Consulting Engineer, and as a witness. He did not admit that steam absorbed sulphuretted hydrogen. He was not a chemist, and would not for one moment contradict Dr. Odling's view. He did differ from Dr. Odling when he said that the effect in Uden's yard was accentuated by steam. The injury to the articles which had been produced arose from sulphur or sulphuretted hydrogen, which might have come from other works besides the Gas Company's. Sulphuretted hydrogen was given off from the boiling of tar; and he had heard that tar was boiled in the neighbourhood of these works. The injury to the metal work came partly from the gas-works. The effect of fog was great in accentuating injury to paint when sulphuretted hydrogen existed. This was in consequence of the impurities in the air being kept down; he could not say that it was the result of humidity.

Dr. *T. Stevenson*, in reply to Sir R. E. WEBSTER, said he was one of the Gas Examiners, and had advised the Home Office for some time. He had inspected the gas-works, the sulphate-house, and the plaintiff's property. Assuming the sulphate-house to be properly managed, and the pipes not to be leaking, sulphuretted hydrogen would not be given off. He had been unable to detect any escape upon the two occasions when he visited the place. At various times he had tested the steam. On one occasion, he had a ladder and went up the 18-inch steam-pipe as high as he could—in fact, he was enveloped in steam; and he not only used the sense of smell, but lead papers. He detected no sulphuretted hydrogen. On the second inspection, he did not go up to the top; but he put the papers into the holes at the bottom, right in the current coming at the time. He again had the tank opened and tested the liquor and the steam above for sulphide and sulphuretted hydrogen; but he found none. Had sulphuretted hydrogen been given off, either in the liquor or the steam, he must have detected it. When purifiers were being cleaned out, a certain amount of sulphuretted hydrogen was found to be given off. Steam, in the scientific sense, of itself would not aggravate the sulphuretted hydrogen; but water did absorb sulphuretted hydrogen, and gave it off again as it was vaporized. As the vesicular steam was again vaporized, the effect of such absorption and vaporization would be that, whenever the vesicular steam actually impinged on a surface—such as a door—there would be some slight increase of effect; but that could only occur where the visible vesicular steam was carried to it. He had never known of visible steam being carried as far as the houses in question. Fogs would carry sulphuretted hydrogen or sulphur compounds in the same way that vesicular steam did. The sulphuretted hydrogen contained in a London fog had not the air round it renewed, so as to carry it off; the result being that the effect was continuous. Fogs would cause discoloration; and fog *plus* gas-works would be worse than fog without gas-works. He could not suggest anything which might be done to improve the works, taking the process as a whole. Having heard the evidence which had been given, he thought it would be as well to condense the steam from the steam-pipe. Sulphuretted hydrogen was not given off when the oxide purifiers were changed.

Cross-examined: In cleaning the purifiers, some sulphuretted hydrogen must be thrown off. The question whether or not sulphuretted hydrogen from gas-works produced a nuisance, depended upon the amount thrown into the air. He admitted that sulphuretted hydrogen could produce a nuisance; and that in large quantities it was very offensive. Large quantities would cause death; and smaller quantities would create nausea. The injury to the houses at the Surrey Gardens arose from sulphide of lead produced from sulphur; but whether or not it came from sulphuretted hydrogen, he could not say. Sulphur in most forms would affect lead.

Mr. *T. H. Nixon*, chief draughtsman to the defendants, produced a plan which had been made from measurements of the tank, the cover, and the top of the sulphate-house. From this, it appeared that the top was tongued and grooved. The sides were of cast iron, with a piece of wood bolted to the top all round, upon which the cover-boards were nailed down.

Mr. *J. Lawrence* was re-called; and, in reply to Sir H. JAMES, said that, in consequence of what had occurred in the Court, he, in company with Mr. Stammers, had visited the Board Schools situate on the South Bermondsey Estate. He found there were two Board Schools; and the injury to them was similar to those of the plaintiff's houses.

Cross-examined: He did not notice the discoloration on the Board School until that morning.

This closed the evidence; and Sir R. E. WEBSTER then proceeded to sum up the case on behalf of the defendants. He said he did not wish to underrate the importance of the evidence which had been given on behalf of the plaintiff; but he did submit that there had been a great exaggeration, and that to a very great extent the impression on the witnesses' minds arose from their not being acquainted with what happened under the particular circumstances of the case. The evidence conclusively established that, apart from any allegation made against the sulphate-house, the quantity of sulphuretted hydrogen emitted, and the possible nuisance that might arise from emission, was less and had been less right up to the present time. The defendants were only doing what they were entitled to do under the statute. He had very great doubt whether, assuming it was a lawful act in sending out whatever degree of sulphuretted hydrogen was emitted, and a lawful act to send out steam, the two combined would give a cause of action.

His LORDSHIP said he had not the slightest doubt in the world that there would be a cause of action, if it was true.

Sir R. E. WEBSTER, at some length, proceeded to analyze the evidence which had been given; and submitted that the defendants had proved that the injury was not due to any unlawful act of theirs. If the Court thought that the Company should condense the steam, they were perfectly ready to do so; but the sole right which the plaintiff would have under those conditions, would be compensation in damages to the extent to which she was called upon to paint the houses earlier than otherwise would have been done. He asked the Court to come to the conclusion that the case launched by the plaintiff had wholly failed; that the sulphate of ammonia house was a harmless agent, so far as any alleged nuisance was concerned; and that the case upon which the plaintiff now sought to support her action at the last moment was not one which disclosed any wrong by the Gas Company, and consequently the action ought to be wholly dismissed.

Tuesday, Feb. 28.

Sir H. JAMES, in replying upon the whole case, suggested that if the action should result in a mere question of damages, it should go to the Official Referee, with such directions as his Lordship might think fit to give. Wherever the gas-works had either caused the necessity of painting or had hastened it, the extent to which it was hastened ought to be given as damages. The Referee might settle the amount to be paid to the plaintiff for this. He hoped that some means would be found for not going through all the items in detail; and he gathered that, if Mr. Livesey had his own way, he would make some suggestion, which probably the plaintiff would accept, if it was reasonable. If needful, the Referee would have to hear evidence as to how far (if at all) the gas-works had necessitated or hastened the time of painting.

Mr. EADY said, if his Lordship thought fit to make an injunction, it might be in the following words: "And the Judge being of opinion that the mode in which the defendants had carried on their works did not, prior to November, 1891, occasion any nuisance of which the plaintiff was entitled to complain."

Sir H. JAMES said, in the event of his Lordship finding for the plaintiff, he should ask for costs to be given upon the higher scale. He thought his learned friends could not say that this was not a case of great importance and difficulty. If the Court did not take this view, the whole amount of damages would be absorbed over and over again; and thus the plaintiff would be without redress.

Mr. EADY said, with regard to this point, he should ask his Lordship not to give costs upon the higher scale—assuming his Lordship ordered the Gas Company to pay the costs—seeing that the plaintiff had raised a distinct issue upon which she had failed. The plaintiff came into the Court with a case that the defendants had caused a nuisance which was injurious to health. This had been given up. No case with regard to that had been made out; and therefore he should ask his Lordship that the costs of the issue upon which the plaintiff had failed should be paid by her. With regard to the injunction, he also submitted that the plaintiff was not entitled to costs.

Sir H. JAMES pointed out that the plaintiff did not claim damages on the ground of injury to health. Dr. Crofton, who had given evidence, had distinctly stated that sulphuretted hydrogen would produce nausea. Discomfort was enough, according to the decided cases. He would also ask his Lordship to look at the special grounds, which were of great importance in this case.

His LORDSHIP said if the matter went to a reference, a large expense might be incurred, as references very often spun out to an enormous extent. He should prefer allowing the Company, if they liked, to offer a sum of money down before going to a Referee.

Sir H. JAMES said, if the Gas Company would deal generously with the plaintiff, he would accept any fair offer. He should have thought the Gas Company *primâ facie* would have to bear the costs, and that they would be generous.

His LORDSHIP: Yes, they may make a fair offer. They will perhaps do their best to meet you.

Sir H. JAMES: If a fair offer is made, we will take an opportunity of considering it; and it may save the expense of going to a Referee.

His LORDSHIP reserved judgment.

Monday, March 6.

To-day his Lordship delivered judgment. He went at considerable length into the evidence on either side, and held that the plaintiffs had established their case. He should therefore grant the injunction asked for, and an inquiry as to damages, to be conducted before Mr. Ridley, one of the Official Referees, unless the parties could agree on a sum. On the application of Mr. Jelf, he stayed execution for three weeks, to give the defendants an opportunity of considering whether or not they would appeal, and, if so, until the hearing. A full report of the judgment will appear next week.

The Gas Consumption of Berlin.—Some interesting statistics of the lighting of Berlin during the past year are given in the *Journal für Gasbeleuchtung*. The total quantity of gas accounted for, from both the English and the municipal works, amounts to 4,062,568,000 cubic feet, against 3,945,185,000 cubic feet in the previous year—an improvement to the extent of 2·98 per cent. On the other hand, the electric light has increased in use 28·96 per cent. during the same period; and the importations of petroleum have advanced 6·5 per cent. The net profit for the year on the municipal gas-works was about £240,000.

NEWCASTLE ASSIZES.—Thursday, Feb. 23.

(*Before Mr. Justice* HENN COLLINS.)

Henderson v. Newcastle and Gateshead Gas Company.

In this case the plaintiff, who was the owner of a house into which the defendants agreed to put gas, complained that the defendants' workmen so negligently conducted the work that, in making the connection between their main and the meter in the house, the gas escaped from the pipes, and afterwards exploded and damaged the premises. The defendants denied negligence, and alleged that, if there was a defect, it was in the pipe belonging to the plaintiff.

Mr. E. TINDAL ATKINSON, Q.C., and Mr. J. STRACHAN appeared for the plaintiff; Mr. J. LAWSON WALTON, Q.C., M.P., and Mr. F. J. GREENWELL for the defendants.

Mr. ATKINSON, in opening the case, said the house, which was situated at Blaydon, sustained very extensive damage by the explosion which occurred in November, 1891. It blew out the whole front of the house, practically destroyed the walls, did a great deal of damage to the furniture, and also injured one of the tenants. The house was a two-storied one, let in flats; the tenants of the upper part being a family named Pinkerton. They were desirous of having gas in their portion of the house; and a plumber named Carr was engaged to do the necessary work inside. Under the floor of the passage from the meter a lead pipe was laid; and to this Carr joined an iron pipe, which was brought outside the house to just beyond the doorstep. The Company's workman then came and joined the iron pipe to the branch of the main; and it was suggested that, through not handling the pipe with proper care, he had fractured the small lead pipe. A smell of gas was noticed while the man was there. The man left, and soon afterwards the explosion occurred, which wrecked the interior of the house. A fracture was found in the gas-pipe near its junction with the iron pipe. In conclusion, the learned Counsel pointed out that the gas beyond the meter was the property of the Company; and the tenant had no power to turn it off.

Evidence for the plaintiff having been heard,

Mr. WALTON addressed the jury for the defence. He said the Company's workmen were under no obligation to creep along under the floor to see that the pipe put in by Carr was in order. The fact was that the pipe inside the house was in a very unsatisfactory condition; and instead of having an iron joint (which, it was admitted on the other side, would have been better), there was a ⅜-inch lead pipe, which Carr had had to splay out in order to make the joint with the ½-inch iron pipe.

The jury returned a verdict for the defendants; and, on the application of Mr. Atkinson, his Lordship agreed to stay execution, in order to allow of an appeal with respect to the defendants' duty to turn off the gas under such circumstances.

Accident to a Gasholder at the Chapeltown Gas-Works.—On Monday morning last week, an accident occurred to one of the gasholders at the Chapeltown (Sheffield) Gas-Works. It was noticed to suddenly rise and tilt. An investigation showed that the cast-iron columns which supported the holder were broken at the foot; and had it not been wedged against the sides of the tank, the whole structure would have collapsed. Information was sent to the Thorncliffe Iron-Works, and workmen were speedily on the spot, and, by means of planks, &c., they prevented the broken columns and the holder from further giving way. The main supplying the holder with gas was immediately shut off; and thus all danger was averted.

City of St. Petersburg New Water-Works Company, Limited.—The report of the Directors of this Company for the half year ending Dec. 31 last (O.S.) states that the gross receipts for water were 270,653 roubles, against 255,420 roubles for 1891; the working expenses being 93,080 roubles, against 98,247 roubles. The rate of exchange was less favourable than in 1891; and the net profit on the year's working amounted to £17,103. Deducting the balance of costs of the lawsuit regarding meters mentioned in former reports (which suit has been finally decided in favour of the Company), and special expenditure incurred in respect of the negotiations for the transfer of the works to the Municipality, the balance remaining suffices to provide for the year's interest on debentures and "B" debenture stock, and to carry £8708 to the credit of the profit and loss account. The Directors propose to pay off the whole of the arrears of interest on the "B" debenture stock. Including the interest for 1892, the amount payable thereon will be 19½ per cent. The negotiations for the transfer of the undertaking to the Municipality of St. Petersburg have been brought to a conclusion; and on the last day of the year the works were formally transferred to the Commission appointed by the Douma. The terms of transfer are as follows: The Douma pays to the Company a capital sum of 100,000 roubles. The Douma also pays to the Company up to the termination of their concession—that is, to May 31 1917—the sum of 84,296 roubles 41½ kopecks at the end of each half year, or 168,592 roubles 83 kopecks for the year; but, if the amount of the revenue for 1892, on verification of the Company's accounts, prove to be less than 168,593 roubles, then the yearly payment would be the smaller sum. The Municipality retain the right to commute the annuity for a capital sum calculated on a 5 per cent. basis. The first half-yearly payment of this annuity falls due on July 1 next (O.S.), unless in the meantime the Municipality should exercise this right. Since the accounts were made up, the capital payment of 100,000 roubles has been received. The whole of the staff in St. Petersburg have been discharged, with the exception of the Manager (Mr. G. A. Carr), who remains to wind up the Company's affairs. The Directors record their sense of the zeal and ability displayed by Mr. Carr during the whole period of his service, and particularly in the course of the negotiations now terminated. In recognition of these services, they will ask the meeting to sanction a special grant of £1000 to him; and they will also apply for power to pay to the staff gratuities not exceeding one year's emoluments—the estimated amount being £2500.

MISCELLANEOUS NEWS.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly Report and Accounts.

In the report which the Directors of this Company will present to the proprietors at the ordinary general meeting of the above Company next Friday, it is stated that, in the six months ending Dec. 31 last, there was a reduction in the price of coal, that tar fell considerably in value, but that the receipts for coke and ammonia were nearly the same as in the corresponding period of 1891. There was an increase of 5·25 per cent. in the quantity of gas sold as compared with the latter half of the preceding year. The receipts for gas supplied for private lighting amounted to £54,248; those for the public lighting, to £4200—making a total of £58,448. Residuals produced £17,137; and the meter and stove rental (£1249) and other rents brought up the revenue to £76,864. The expenditure on the manufacture of gas was £50,764 (£33,231 being for coals and carburine and the attendant labour); on distribution, £3854; on management, £3085—the total expenses being £61,052. This left a balance of £15,812 to go to the profit and loss account. The amount available for division is £14,892, which is sufficient to pay the statutory dividends, and leave £17 to the good. These the Directors recommend to be declared. The working statements show that 44,907 tons of coal, 218 tons of cannel, and 10,232 gallons of carburine were employed in the manufacture of gas; the quantity of which made in the past six months was 462,673,000 cubic feet. The residual products were: Coke, 541,500 cwt.; breeze, 5596 yards; tar, 451,130 gallons; ammoniacal liquor, 902,500 gallons—yielding 292 tons of sulphate of ammonia.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday week, at the Offices, Willoughby Lane, Tottenham—Mr. G. GRIPPER, J.P., in the chair.

The SECRETARY (Mr. J. Randall) read the advertisement calling the meeting; and the Directors' report and the accounts (which were noticed in last week's issue) were taken as read.

The CHAIRMAN said that, before moving the adoption of the report, he wished to make a few observations. In the opinion of the Directors, their statement was a most satisfactory one; it fulfilled the prophecy they ventured to make at their last meeting, that, in the past half year, the whole of the dividend would be earned. This had been realized, with a considerable excess—something like £1876—to carry forward. He wished to draw attention to the fact that not only had they accomplished this, but they had been able to pass through the last five or six half years without doing that which almost every gas company had been compelled to do, and that was raise the price of gas. The Directors told the shareholders a year since that they hoped they would be enabled to carry on the business without increasing the price. It had always been their policy to sell gas at the lowest figure remunerative to the shareholders; and that they were, without advancing the price or reducing the dividend, when on the point of having almost exhausted their accumulated undivided profits, in a position to pay the dividend and begin to put something by, was a matter upon which they could congratulate themselves. In 1886, the undivided profits amounted to £5000; while last year they had been reduced to £235. When they had again a good sum in hand, they should reduce the price of gas. The sale of gas had increased very largely—the receipts having been higher by £2617, or equal to 10·37 per cent. on the corresponding period of last year. Fortunately, coal showed a reduction of 1s. 7d. per ton. This was not altogether on the price, but partly a saving in labour, due to the new hoisting machinery which they had put down for coal and coke. The next matter he had to refer to was one which, he believed, had been foreshadowed on a previous occasion. The Directors had thought it better to secure more land for additional works, which they now found almost imperative; and they could well occupy the whole of the new site. The opportunity occurred of buying nearly six acres of land running out from their works parallel with the Great Eastern Railway. They had had a most advantageous offer, which they thought they would not be justified in refusing. They bought some of this land, eleven years ago, at £500 an acre. The Company were then compelled to purchase; but they were not now compelled, and were buying it for £250 an acre, and some contingent expenses would run the price up to £300 an acre. This was a good investment. To meet the gas consumption and the increased trade, they must go on enlarging the works; and the first step was to erect a new holder. They had the specifications and plans for the holder, which would cost a considerable amount of money—about £20,000. This step, however, they must take, because the fortnight before Christmas and the fortnight after, they were fully working every one of the retorts. Had anything then happened to one of the retort-beds, the district would have been put into partial darkness; and they were not justified in running that risk. The holder would be erected in the immediate future; and it would have to be followed by an extension of their producing power. He then moved the adoption of the report.

Sir HENRY CARTWRIGHT, in seconding the motion, referred to the steady progress of the business. He said that to those who, like himself, had had an interest in the Company from its early days, it did seem a remarkable thing that it should have grown from year to year until it had assumed such great proportions as it had; for they had distributed during the past half year 176 million cubic feet of gas. This development must be very satisfactory to the shareholders. Besides, it was most gratifying to them to know that the consumers showed their appreciation of the supply by paying up their accounts regularly—so regularly indeed that, during the past six months, with a rental of £28,000, there was only £161 in arrear. As the Chairman had observed, the Directors had always before them the question of keeping the price of gas at as low a figure as was conducive to the interests of the Company. Other gas companies had recently taken advantage of

the state of the labour market and the variation in the price of coal to raise their charges. The Gaslight and Coke Company had advanced their price; while, in their own case, with the view of inducing the consumers to increase the quantity of gas consumed, they had not done so. He thought it was very much in favour of the Company to be able to say this, and to feel that the interests of the consumers were not overridden by the desire to make great dividends for the shareholders.

The motion was unanimously carried.

Mr. CORBET WOODALL moved the declaration of dividends (less income-tax) at the rates of 11½ per cent. per annum on the "A" stock and 8½ per cent. on the "B" and "C" stocks. In doing this, he remarked that it had been his duty to propose this resolution on previous occasions; but he did not think he had ever done so with more satisfaction than he did that day. As the Chairman had remarked, they had for some half years proposed the payment of ordinary dividends when the accounts had shown that they had not earned them; but they had now turned the corner just when they had practically exhausted the uninvested reserve which enabled them to make these payments. He agreed with Sir Henry Cartwright in his congratulations to the shareholders on the fact that the Directors had not been called upon to increase the price of gas; but he ventured to deprecate what appeared to be a comparison of their policy and that of a large neighbouring Company. In their own case, they had paid the whole of the dividends they were entitled to; but The Gaslight and Coke Company had not done more than that, but rather less—they had not paid fully up to the amount that their Act of Parliament allowed them. As to whether in their own case it was right to accumulate a little reserve of undivided balance, or whether the price should be so promptly reduced that they had no reserve in hand, he thought the history of the last few years justified the policy of the Board. But at the same time there was something to be said in favour of the policy of their neighbours—that it was not for the object of paying extravagant dividends that they had raised the price of gas, because no increase of dividend had resulted from it. It might be interesting to know that, while they had used in the past six months rather more than 1000 tons of coal in excess of the corresponding period of 1891, they had paid for it about £600 less; but, on the other hand, while they had consumed 1000 tons more coal, they had realized from coke, tar, breeze, and ammonia, £1600 less.

Mr. WALTER LOWE seconded the motion, which was agreed to.

On the proposition of Mr. H. MOORE, seconded by Mr. J. B. DOE, a vote of thanks was passed to the Board; and a similar compliment was paid to the Secretary, Engineer, and staff, on the motion of Mr. J. L. CHAPMAN, seconded by Mr. S. CUTLER.

Mr. RANDALL and Mr. BROADBERRY both replied. In the course of his remarks, the latter gentleman said that at the previous meeting he felt a little bit afraid they would not be able to go on without increasing the price of gas; and it was a great relief to him to find they had now turned the corner. He also mentioned that during the past year the increase in the quantity of gas made was 22,589,000 cubic feet.

The proceedings then terminated.

PROVINCIAL GAS AND WATER COMPANIES.

The following paragraphs contain particulars of the working of various Provincial Gas and Water Companies, taken from the statements issued by the Directors and the reports of the proceedings at meetings of shareholders.

Gas Companies.

The Directors of the Abingdon Gas Company had little to report to the shareholders at the half-yearly general meeting last Thursday. The accounts they presented, however, showed that the balance of net profit on the working in the six months ending Dec. 31 last was £1468; and out of this it was recommended to apply £500 in reduction of the temporary loans, and to declare dividends of 5s. and 3s. 6d. each on the two classes of shares. This would leave £623 in hand.

In moving the adoption of the Directors' report at the half-yearly meeting of the Barry Gas and Water Company last Tuesday, the Deputy-Chairman (Mr. E. Handcock) referred to the action taken by the Barry and Cadoxton Local Board in promoting a Bill in the present session of Parliament for the compulsory purchase of the undertaking, and said he could assure the shareholders that the Directors were taking all necessary steps to protect their interests. The Company had been treated very badly by the Local Authority, though they had done all they could for the inhabitants; and if the works had to be sold, they ought to obtain a good price for them, and they intended to get it. The report, which was a very satisfactory one, was adopted; and a dividend at the rate of 5 per cent. per annum was declared.

The half-yearly general meeting of the Bromley Gas Company was held on Monday last week, when Mr. R. Latter moved the adoption of the report, of which the principal portions were given in the JOURNAL on the 21st ult. In doing so, he remarked, in reference to the necessity for increasing the manufacturing capacity of the works, to which allusion was made in the report, that it would not be safe to go through another winter with the present plant. In reply to questions, he stated that the Directors contemplated spending about £40,000 within the next six or seven years; but that they had not thought about furnishing a cheaper gas for heating purposes, as the cost of laying the necessary pipes would be very expensive. The report was adopted; and the proceedings closed with the usual complimentary votes of thanks to the Directors, as well as to the Engineer (Mr. W. Woodward) and the Secretary (Mr. H. W. Amos).

In the report submitted at the annual meeting of the Chelmsford Gas Company last Saturday week, the Directors informed the shareholders that they had found it necessary to provide at the works a new steam-boiler and a stack of retorts. Notwithstanding the competition of the electric light and oil-lamps, and the continuing high price of coal, the profit and loss account showed a balance available for dividend of £2070, from which the Directors recommended a dividend of 7 per cent. per annum on the original capital, and £4 18s. per cent. on the additional capital. The Chairman (Mr. W. Duffield), in moving the adoption of the report, said the result of the year's working was a subject of congratulation, and particularly when they took into consideration the price of coal. In proportion to the coal carbonized, and the amount received from the residual products, the expenditure, he mentioned, was considerably less in 1892 than in 1882. The expense of carbonizing 100 tons of coal in 1882 was £78 8s.; in 1891, £63 15s. 6d.; and in 1892, £57 11s. 6d. In his opinion, they never stood in a better or more prosperous condition than at the present moment, and had very good prospects. The report was adopted.

The shareholders of the Derby Gas Company held their half-yearly meeting last Saturday week, and received a report from the Directors showing a very satisfactory increase in the sale of gas, and a considerable saving in the cost of production. On the other hand, they had to regret the loss to the revenue by the depreciation in the value of the residuals. The statutory dividends at the rates of 10, 7, and 5 per cent. per annum upon the respective classes of stock were recommended. The Chairman (Mr. H. Swingler), in moving the adoption of the report and accounts, said he was pleased to state that, instead of having to withdraw the sum of £5054 from the reserve fund as they did in 1891, they only required £1865 to make up the dividends for the past year. With regard to the consumption of gas, that was very satisfactory—the increase being something like 19 million cubic feet as compared with 1891, which was equal to 4·64 per cent. On the capital account they had spent £8525; the principal item being in the purchase of land at Litchurch. They had completed this transaction, and were now in a position, when it was forced upon them, to commence the works, which he hoped they would soon require, and which, he might say, would be needed very shortly if they went on extending their business at the rate they had been doing during the past year. With regard to the revenue account, the increase in the receipts last year amounted to £5565. The report and dividends recommended were agreed to.

The ordinary meeting of the Eastbourne Gas Company was held on Monday last week. The Directors' report for the half year ending Dec. 31 last stated that during the six months there was a profit on the revenue account of £4872, which, added to the balance brought forward after payment of the dividend in August last (£8084), gave a total sum of £12,956 available for the dividends. The Directors recommended dividends at the rate of 13 per cent. per annum upon the £20,000 original capital and also upon the amount raised on the "C" shares (£12,490), and at the rate of 10 per cent. upon the £55,000 paid-up capital raised on the "B" shares, which would absorb the sum of £4862, and leave a balance of £8094 to be carried forward to the next accounts. The Chairman (Dr. G. A. Jeffery), in moving the adoption of the report and balance-sheet, congratulated the shareholders on the continued prosperity of the Company. In analyzing the work of the past six months, he said the sale of gas had amounted to 102,270,000 cubic feet, as against 97,115,000 feet in the corresponding six months; the increase being 6 per cent. This was especially satisfactory, if they took into account the mild weather up to December last. They had used 10,333 tons of coal; each ton producing 10,523 cubic feet of gas. The leakage had been reduced from 5·7 to 4·7 per cent., which was highly satisfactory. The yield of sulphate of ammonia and tar showed a small improvement. There had been a little saving in the price of coal; it being at the rate of ½d. per 1000 cubic feet of gas. The selling price of tar and coke had been lower than in the corresponding half; but breeze had fetched a higher price. There had been a small increase in wages and salaries, and also in rates and taxes. Considering the depreciation in the value of residuals, the reduction in the price of gas, and the outlay on repairs at the works, their position was, he thought, eminently satisfactory. Mr. Farncombe seconded the motion, which was carried unanimously. An extraordinary meeting was afterwards held, at which the Directors were empowered to raise further capital to the extent of £15,000.

At the recent annual meeting of the East Grinstead Gas and Water Company, the Directors reported that the receipts from the sale of gas in 1892 were £2610, from residuals £584, and from water £1102. The accounts showed an available balance of £1017, from which the Directors recommended dividends of 5 and 3½ per cent., free of income-tax. A new gasholder was finished just before Christmas; and the Directors expressed a hope that this increase of storeage would lessen the expenses at the works. The report was approved.

The accounts for the year ending Dec. 31 last which were presented to the shareholders of the Harrogate Gas Company at their meeting last Tuesday showed a sum of £7418 available for division. Out of this, the declaration of the statutory dividends was recommended. The report (which was signed by the Secretary, Mr. H. Wilkinson) stated that the capital outlay during the past year had been restricted to urgent work; and, as far as practicable, a similar policy would be pursued in the current twelve months. It was anticipated, however, that considerable extensions would be necessary in order to meet the increased demand for gas, and the requirements of the growing business connected with gas stoves and fittings. The report was adopted; and the dividends were declared. These, with interest on debentures, equalled 9¼ per cent. on the total capital receipts.

Notwithstanding the existence of electric lighting at Hastings, the business of the Hastings and St. Leonards Gas Company was reported by the Directors, at the meeting of the shareholders last Thursday, to be in an increasing and satisfactory condition. It having become necessary to provide additional storeage accommodation, arrangements have been made for the erection, during the coming summer, of a gasholder having a capacity of 650,000 cubic feet. The accounts accompanying the report showed receipts to the amount of £36,551 in the six months ending Dec. 31 last, and expenditure to the extent of £25,907—£16,674 being for coals, inclusive of £2000 duty paid to the Hastings Urban Sanitary Authority. The balance carried to the profit and loss account was therefore £10,644; and the amount available for distribution was £41,525. The Directors proposed dividends at the rates of 12 and 9 per cent. per annum, and to carry forward the balance. During the latter half of last year the works (under the supervision of Mr. Charles E. Botley, Assoc.M.Inst.C.E., the Engineer and Manager) dealt with 16,614 tons of coal and 223 tons of cannel; the quantity of gas produced being 170,732,000 cubic feet. The residuals were 10,366 tons 17 cwt. of coke, 763 tons 19 cwt. of breeze, 166,040 gallons of tar, and 359,736 gallons of ammoniacal liquor. The adoption of the report was moved by Mr. J. Brown,

the Chairman of the Company. In doing so, he remarked that the principal thing that had worked well for them was the great increase in the quantity of gas produced. They had made during the past half year 5½ million cubic feet more than in the corresponding period of 1891. The new holder which the Directors proposed to erect would cost £10,000 or £11,000. The Corporation intended to have the electric light all along the sea-front in lieu of gas. If the light could compete in other ways with the Company, it could not do so in price. The Electric Light Company were going to lower their price to 8d. per unit. But this meant about 8s. per 1000 cubic feet for gas; and if they could supply gas at 3s. 9d., the electric light was nowhere near competing with them at the present time. The amount paid by the Corporation for light had increased to £6141, independent of the charge for the electric light; so the Gas Company must still consider them as their best customers. As time went on, they would increase the supply of gas to the Corporation. He did not think the electric light was going to injure them in any way. As showing the progress of the Company, he mentioned that the quantity of gas made in 1882 was 202 million cubic feet; whereas last year it was 335 millions. The report was adopted.

The annual general meeting of the Redhill Gas Company was held on the 16th ult., under the presidency of Mr. J. Lees, J.P. In their report, the Directors stated that the business continued to show a steady and withal satisfactory increase; and that they were watching the development of the neighbourhood, and would be prepared to extend their mains as required. The accounts showed a balance of £4510, of which the Directors had appropriated £200 for the reserve fund; leaving £4310 available for distribution. They recommended a dividend at the rate of 10 per cent. per annum. As an interim dividend of 4½ per cent. was paid in September last, there would be a balance of 5½ per cent. In moving the adoption of the report, the Chairman referred to the excellent position of the Company, as shown by the fact that no draft had been made on the reserve fund, while the profit made was higher than in the previous year. He then passed on to deal at some length with the labour question, and with the threatened strike in the coal trade. He condemned strike movements; remarking that, if the men would only look a little at what was going on around them, they would wake up to the fact that the demagogues were only misleading them; that the people who came over here and incited them to set men against masters, labour against capital, and all that sort of twaddle, were only trying to take from this great country the trade which had been the making of the kingdom. Having alluded to matters of local interest, he reverted to the position of the Company, and quoted figures to show that their working generally (under the supervision of Mr. C. Read, the Chief Clerk and Manager) compared favourably with the two largest London Companies. The report was adopted.

The 76th half-yearly general meeting of the Sheffield United Gas Company will be held next Thursday. In the report to be presented on that occasion, the Directors state that there was a satisfactory increase in the number of the Company's customers, both for gas and fittings, in the six months ending Dec. 31 last, but a falling off in the amount realized for residuals. The total receipts came to £148,038; and the expenditure to £116,583—leaving a balance of £31,455 to go to the profit and loss account. The sum available for division is £33,236; but, as £36,705 is required to pay the maximum dividends which the Directors recommend, £3469 will have to be taken from the reserve fund. There were 102,307 tons of coal and cannel carbonized in the six months covered by the report; the residual products being 61,481 tons of coke, 6611 tons of tar, and 3,169,500 gallons of ammoniacal liquor. With regard to the Provisional Order for which the Company are applying to the Board of Trade, the Directors do not anticipate any difficulty as to obtaining it.

At the annual general meeting of the South Shields Gas Company last Tuesday, the Chairman (Mr. R. Wallis) moved the adoption of the Directors' report, the principal portions of which were given in the JOURNAL last week. In doing so, he referred to the fact that the year 1892 was the centenary of the successful manufacture of coal gas by Murdoch; and he remarked that it was hardly possible to realize the importance of this event on the social, commercial, and industrial position of the kingdom, and indeed of the world. It was essentially a British industry—British capital, and British coal and enterprise being involved in it; and it had spread to the farthest limits of civilization. At its inception it had against it all the prejudices of public opinion which every new invention had had to contend with; and it had also the same rivals it had in the present day. But now gas had outstripped them all; and it would, he believed, continue to outstrip them as long as the English coal-fields lasted. Having briefly alluded to the progress made in gas manufacture since Murdoch's time, he went on to say that the principal matters under discussion at the present day were the advantages of inclined retorts, and the use of carburetted water gas or oil gas to increase the illuminating power of ordinary coal gas and to cheapen its production. These matters were, he said, being experimented upon at some of the principal gas-works in the kingdom; but their claims were not yet sufficiently established to warrant the Directors of the South Shields Company in adopting any of them. Coming to the matters contained in the report, he referred to the substantial increase which had taken place in the sale of gas—about 5 million cubic feet—over the preceding year. That was so far satisfactory; but it was more so than it at first appeared to be. Notwithstanding that one factory had ceased to exist, that another had been in process of re-construction after fire during the greater part of the year, and that twelve other large factories had consumed 10 million cubic feet less gas on account of the Durham Miners' strike, they were still able to record an increase of 5 million cubic feet in the consumption. This was chiefly owing to the erection of new property and industries within their district. The more favourable contracts made for last year would have shown a decrease of expenditure of about £2700; but the Durham strike cost them £1205. If it had not been for that, they would have been able to pay the full dividend without drawing on the reserve fund. The loss on the residuals had no mitigation. All they could hope for was that they would rise again when the "boom" of prosperity set in. Referring next to the proposal to increase the salary of the Secretary (Mr. J. H. Penney) by £100 per annum, he said that the Directors were unanimously of opinion that this recognition of good service should be no longer delayed. He was not going to eulogize Mr. Penney, for he was well known to all of them as an honourable, upright man, and as a sound and able financier. He had served the Company for 28 years, during 18 of which he had held the position of Secretary. For eight years his salary had not been revised, although his duties had been doubled. Mr. Williamson seconded the motion, and it was carried unanimously. The dividend of 5¾ per cent. recommended by the Directors, making 9¼ per cent. for the year, was then declared; and the Secretary's salary was subsequently raised by the amount suggested. The proceedings closed with the usual complimentary votes.

The Directors of the Walker and Wallsend Gas Company report that, in consequence of the depression in trade, there has been a decline in the Company's income for gas and coke during the past year. This, however, has been largely counterbalanced by a reduction in regard to the cost of coals and working expenses; leaving the net profit about £600 below that of 1891. A new retort-house and other extensions at the Willington works are nearly completed. An interim payment of 4 per cent. for the first half of last year was made in August; and a similar dividend was declared for the past six months at the meeting of the shareholders yesterday week.

The West Kent Gas Company held their half-yearly meeting yesterday, when the Directors' report (which was signed by the Secretary Mr. R. P. Keys) stated that the profits in the six months ending Dec. 31 last were £295 more than in the corresponding period of 1891. The amount available for division, however, was insufficient by £373 to pay the statutory dividends without drawing further upon the undivided balance from previous years, which still amounts to £1743. The total receipts were £7301; and the expenditure was £4692—leaving a balance of £2609.

At the annual meeting of the Wolverhampton Gas Company last Tuesday, the Directors reported that there was a divisible profit of £7918; and they recommended the payment of a dividend on the consolidated stock at the rate of 10 per cent. per annum, and on the preference shares at the rate of 6 per cent., less income-tax. The Chairman (Mr. H. W. Owen), in moving the adoption of the report, stated that the Company's Bill had been read a first and second time in the House of Lords. The Board had discussed the provisions of the Bill with deputations from the Wolverhampton Town Council and the Tettenhall and Wednesfield Local Boards; and there was every reason to believe that the measure would pass the final stages. During the half year a number of improvements had been made at the works, and larger mains had been laid where required, in order that a full supply of gas could be ensured to the consumers; and as soon as the Bill was passed, the necessary arrangements would be made for the extension of the works. The motion was agreed to; and the dividends recommended were declared.

Water Companies.

The business of the East Warwickshire Water Company is making steady progress. The number of houses connected to the mains at the close of the past half year was 1460, as compared with 1355 in the preceding six months; and the gross amount of the water-rental was £726, as against £663.

In addressing the shareholders at the meeting of the East Worcestershire Water Company on Monday of last week, the Chairman (Lord Windsor) stated that the net profit for the half year ending Dec. 31 last was £826; and he thought this was very satisfactory. The total amount received as water-rents in the six months was £1835, as compared with £1496; and this was a decided step forward. Negotiations had been going on for some time past for the supply of water to Rednal; and a letter had been received from the King's Norton Rural Sanitary Authority accepting the terms of the Company. The increase in the revenue was such that he looked forward to their position being very much more improved when they again met.

The report submitted and adopted at the half-yearly meeting of the Maidstone Water Company last Thursday week stated that the water-rents for the six months to Dec. 31, 1892, were £4474; and there was a profit of £1944—making £5348 to the credit of profit and loss account. The Directors recommended the payment of a dividend for the half year of 4¼ per cent. on the 10 per cent. shares, and of 3 per cent. on the 7 per cent. shares. These payments would absorb the sum of £1909, and make the dividends for the year 8¾ and 6¼ per cent. respectively.

The report of the Newcastle and Gateshead Water Company for the past year (which was summarized in last week's issue) came before the shareholders at their meeting on Tuesday. In moving its adoption, Colonel Addison Potter, C.B., said the balance-sheet was very satisfactory; and it must be gratifying to the shareholders that, though the strikes in the beginning of the year interfered very much with the profits of the Company, yet they were able to make such a good increase in their revenue as to enable them to pay so large an amount as was required for interest and dividend, and also to add the substantial sum of £600 to the considerable balance which they carried forward last year. There was one item in the balance-sheet that possibly some of the shareholders might think rather large—that was, the water-rents due. This item amounted to £11,523. But it was really the manufacturing accounts for the quarter ended Feb. 1, 1893; and the only actual arrears were £715, which was merely 1¼ per cent. on the rental. There was another item of £45,346 premium. That was also satisfactory, because it was addedc apital for which they paid no interest or dividend whatever. With regard to the supply, the laying of the 30-inch pipe from Rye Hill to Newburn was finished a year ago, and was connected with the Throckley filter-beds, and had been regularly supplying Newcastle since that time. The second portion of the pipe between Newburn and Whittledene was now completed, and ready to be attached to the clear-water tank as soon as the connection could be made. The large quantity of water that would come down this pipe, amounting to 8 million gallons per day, and increasing the daily capacity of their pipes to nearly 24 million gallons, necessitated a considerable expense in distributing the water; and they had had a very large extension of the pipes for that purpose, costing about £15,811. The normal amount for these extensions was between £8000 and

£9000 annually; and, during the last three years, they had spent £42,000 upon extensions, principally in the city. The 42-inch main which had been put down in replacement of the earthenware pipes, which had got into a very bad condition, was now also finished, and waiting to be attached to the filters at Throckley to be brought thoroughly into use. The report was adopted; and the dividends recommended were agreed to.

The ordinary meeting of the South Staffordshire Water Company was held last Thursday week. Mr. F. James presided; and in moving the adoption of the Directors' report (to which reference was made in these columns on the 14th ult.), he mentioned that the number of houses laid on during the half year ending Dec. 31 last was 1579—making the total supplied 78,094. They had in operation two new pumping-stations, doing very good, active service; they had a third which would be in operation within a couple of months; and a fourth in the course of the year. The expenditure on capital account during the six months had been £12,000, although only £8900 had been added to the cost of works at Shenstone, Cradley, Kingswinford, and Bourne Vale. The gross amount of the water-rates was £40,243, against £39,210 in the corresponding period of last year, and £39,028 in the previous half year. After providing for interest on debenture and preference stock, &c., there remained a balance of £18,634, against £18,334. A sum of £3217 would be carried to the credit of the next six months, after the absorption of £15,417 in the payment of dividend at the rate of 5½ per cent. Mr. J. N. Brown seconded the motion, which was unanimously agreed to, as was also the recommendation that a dividend on the ordinary stock at the rate of 5½ per cent. should be declared. Referring subsequently to the Company's Bill now before Parliament (to which allusion is made in another column), the Chairman said he could not conceive that Parliament would confiscate their property; but at the same time, when they were last there, something of the kind was attempted to be imposed upon them, which caused the Directors to throw up the Bill. Parliament might give the petitioning authorities a *locus standi*, though he could see nothing in the measure that would interfere with them, except to benefit their districts. He hoped the Company would come successfully through the ordeal.

The annual meeting of the Sunderland and South Shields Water Company was held on the 23rd ult. In moving the adoption of the Directors' report, the Chairman (Mr. J. Stokoe) made an interesting comparison of the principal items in the accounts, and showed that the water-rental had amounted to £67,083, as against £69,555, or a decrease of £2472. This decline he attributed to the depressed state of trade in the district. The net increase in the expenditure was £1435; and the balance of profit was £34,811, against £38,698 in the previous year. In the profit and loss account, the interest on bonds and mortgages came to £1344; income-tax, to £1018; and the interim dividend, to £15,646. The balance on profit and loss account amounted to £37,480,as against £35,807. Referring to an item of £1102 in the revenue account for engineering and law charges, he said the shareholders would remember that last year it was stated that the Directors felt it was desirable, guided by their Engineer, to endeavour to obtain, if possible, a site for a pumping-station in lieu of the one previously decided upon, and which Parliament did not sanction. They entered into negotiations for a new site; and, an agreement being come to, they took the preliminary steps to go to Parliament for the necessary powers. It was afterwards found that there was a well in the neighbourhood furnishing a liberal supply of water for colliery purposes and to a considerable population of the district. It had been thought that the Company's station might affect this well; and they were asked to supply water to make up for the probable loss. The quantity of water required might have meant a large percentage of the output; and the Directors thought it would be unwise for them to accept any such arrangement, and they decided not to incur such a responsibility. In consequence of this, they withdrew the Bill; and this was the cause of the large expenditure he had alluded to. The motion was seconded by Mr. W. Cay; and, after a brief discussion, it was unanimously carried. A dividend of 4½ per cent. for the past half year (making 9 per cent. for the year) was declared on the ordinary and preference stocks.

The West Surrey Water Company's half-yearly general meeting was held last Tuesday, under the presidency of Mr. A. Telford Simpson, M.Inst.C.E. The notice convening the meeting having been read by the Secretary (Mr. H. G. Thompson, Assoc.M.Inst.C.E.), the report was presented. It showed that the income for the six months ending Dec. 31 last amounted to £2892; and the expenditure to £1002. Compared with the corresponding period of 1891, there was an increase of £173 in the income and of only 14s. 5d. in the expenditure. Nearly 4000 yards of 3-inch cast-iron pipes were laid for the extension of the service mains; and 91 new supplies were connected, representing a future rental of £200 per annum. The Engineer and Manager (Mr. J. K. Hill) reported that the whole of the Company's plant was in good order. The amount available for distribution was £2264. The report was adopted; and dividends at the rates of 5 and 6 per cent. per annum were declared upon the preference shares, and of 4½ per cent. per annum on the ordinary shares.

The half-yearly meeting of the Woking Water Company was held at the London Offices last Tuesday. Mr. Charles Horsley, J.P., presided; and, in moving the adoption of the report and accounts (which were briefly referred to in this column last week), said he thought the accounts would be very satisfactory to the shareholders, as they had been to the Directors. The total expenditure on capital account stood at £70,939, which was an increase of £3355 during the half year. The revenue showed an increase of £288. The amount at the credit of the profit and loss account (£2791) enabled the Directors to recommend a dividend for the past half year at the rate of 4 per cent. per annum, and also to write £50 off preliminary expenses and £50 off the deferred interest on the provisional obligations—leaving a balance of £109 to be carried forward. As far as those figures went, they spoke for themselves. The revenue had increased, and the working expenses were a very little more. With regard to the £10,000 additional capital authorized to be raised, he was pleased to say the Directors had not so far had to offer these shares to the public; the shareholders having responded very well indeed. The Company was progressing slowly; and he hoped the next accounts would be quite as good as, if not better than, the present. Mr. R. Hesketh Jones, J.P., in seconding the motion, remarked that the shareholders would recollect that it became necessary for the Company at one time to take up provisional obligations. During the past year, they had got rid of these obligations by converting them into mortgage debentures; and therefore, instead of the interest being left over to a future time, each year would bear its own interest. Last year their capital account stood at £15 13s. 9d. per £1 of revenue; and it had since been reduced to £15 7s. The resolution was carried; and the dividend recommended was adopted. The retiring Directors and Auditors were also re-elected.

GAS AND ELECTRIC LIGHTING AFFAIRS AT ROTHERHAM.

Enlargement of a Gasholder.—An Inquiry into Electric Lighting.

At the Meeting of the Rotherham Town Council last Wednesday, the Gas Committee reported that they had considered the question of extra storeage accommodation; and their Engineer (Mr. C. B. Newton) had advised that two extra lifts be put to the present large gasholder, at an estimated cost of £5000. The Committee recommended that this should be carried out, and tenders for the necessary work advertised for. At a subsequent meeting of the Committee on Feb. 28, the tenders were considered; and it was recommended that the one sent in by Messrs. Westwood and Wright, of Brierley Hill, for £6220, be accepted. The adoption of the report having been moved and seconded, Mr. Hirst proposed an amendment to the effect that the recommendations should be referred back to the Committee. He argued that the work was unnecessary; that the cost was almost one-third beyond the Engineer's estimate of £5000; and that the placing of two lifts on an old gasholder was extremely dangerous, because in case of a hurricane they might possibly find the structure blown over. He was bringing forward a resolution to establish an electric lighting plant; and this might be considered a reason for delay. Mr. Jenkins seconded the amendment. Mr. Stoddart, the Chairman of the Committee, supported the recommendations. He said the whole matter had been well considered in Committee; and the minutes had been passed by a majority of 10 against 3. In the past year the increased consumption of gas had been nearly 6 per cent., or 5 million cubic feet. When Mr. Jenkins was Chairman of the Gas Committee, he stated that it was absolutely necessary additional holding accommodation should be provided to carry on the works. If this was necessary some three or four years ago, what was the position when they had to arrange for an increased production of 12 million cubic feet of gas? In his (the speaker's) opinion, the additional outlay would more than recoup itself. As to electric lighting, the Council could not do anything for twelve months at least. They would have to apply for a Provisional Order; and the possibility was that they might be kept waiting eight or nine months beyond the time. The amendment was lost, and the recommendations were then adopted.

At a later stage of the proceedings, Mr. Hirst moved the appointment of a Sub-Committee to inquire into, and report to the Council upon the cost of an electric lighting plant, the most suitable site, the probable revenue, and any other information likely to assist the Council in deciding whether it was advisable to establish the electric light in the borough. In a lengthy speech, Mr. Hirst argued that the present was a favourable time for the introduction of the electric light into the borough, and spoke of the convenience and advantage to be obtained by its use. Dealing with the question of finance, he gave details of an installation to provide for 5000 lamps of 16-candle power. The cost, roughly speaking, for boilers, engines, dynamos, exciters, switch-boards, and condensing plant he estimated at £7500; transformers, £750; underground mains, £3000; and buildings, £2000. Altogether he reckoned the outlay at £15,000; and the profit upon that outlay when the plant was in working order, at £2000. The motion having been seconded, Mr. Stoddart said he had no objection to electric lighting; but he thought the resolution was forestalling the Chairman and the members of the Gas Committee, who had instructions to get out particulars as to the cost of electric lighting. He regarded Mr. Hirst's figures as open to considerable extension, and would be surprised if such a scheme did not reach an expenditure of from £24,000 to £25,000. He also doubted whether there would be the remuneration for the outlay which Mr. Hirst anticipated. The proposition was carried; and Mr. Newton has been instructed to prepare estimates, &c.

MESSRS. FLETCHER, RUSSELL, & CO.'S LONDON SHOW-ROOMS.

In order to meet the convenience of their customers, Messrs. Fletcher, Russell, and Co., Limited, have recently altered and rearranged their Cheapside show-rooms, so as to bring samples of the goods they manufacture under one roof, instead of having one section in Cheapside and another in Queen Victoria Street, as hitherto; and they have succeeded in making a very effective display. What strikes one most in walking through the establishment is the great advance lately made in the embellishment of both gas and coal stoves—especially the former class—and in giving them an appearance suitable to the room in which they are intended to be used. The clerical department has been moved to a spacious, light room at the top of the building; and the floor below is devoted chiefly to gas and coal consuming stoves suitable for bed-rooms and halls, and to cast-iron lavatory fittings. The bed-room stoves are shown with cast-iron mantels and overmantels, very finely and smoothly cast, and finished in various shades of enamel. The next floor (which was formerly used as the office) is devoted to gas and coal stoves for dining-rooms; and the one beneath that to stoves for drawing-rooms, most of them in both cases being fitted with cast-iron mantels and overmantels of various designs, tiled panels, curbs, fire-irons, and even ornaments and vases, in order to give the visitor an idea of what they would look like when set up in a room. These mantels and overmantels are really very handsome; one of the most striking and popular being named the "Jubilee." The castings are clean and neat; and they are finished in various shades of enamel, or painted and grained in oak

walnut, rosewood, and in granites or marbles. It is obvious that, being constructed entirely of cast-iron, they are very durable; and their price in comparison with woodwork, is exceedingly moderate. Before leaving these departments, mention should be made of the "Withington" grate, which is partially smoke consuming. It is claimed for it that it gives great heating power, with a small consumption of fuel, by its heat-reverberating principle; and, by the air-regulating ash-pan placed under the fire, combustion can be regulated to any degree. On the ground floor are arranged gas cooking and heating stoves and appliances of various descriptions. The new "Bengal" gas-fire (the general appearance of which gives one the impression that it will prove very serviceable and popular) is shown; and among the other apparatus to be seen is a new water-heater for baths, in which improvements are contained which do away with two objections to old gas water-heaters. First, before the gas can be lighted, a pilot-jet has to be withdrawn and ignited; and then the opening of the gas-tap turns the jet into position, and closes the aperture so as to prevent a taper being applied —thus obviating the risk of an explosion. The second improvement consists in the connection of the gas and water taps in such a manner that it is quite impossible to light the gas until the water has been turned on. We might point out, among the cooking-ranges of this firm, the "Connaught," "Grosvenor," also the "St. James's" oven, which are used in hotels, restaurants, and public buildings; and there is a specially-designed range which the Company alone are making for the School Board for London. Space will not permit of mention being made of the many other useful appliances manufactured by Messrs. Fletcher, Russell, and Co., Limited, and shown in their Cheapside premises. Before concluding, however, it may be of interest to state that, at the commencement of the present fire season, the firm were executing orders at the rate of upwards of 2000 gas-stoves a week; and from their Tabernacle Street warehouse alone, 20 to 30 cast-iron overmantels and 60 to 100 mantel registers were being sent out. At Manchester they cast on an average 25 tons a day; 11½ to 12 tons being used in the mantel and overmantel section.

SOUTH STAFFORDSHIRE WATER COMPANY'S BILL.

A Special Meeting of this Company was held last Thursday week, at Birmingham, to consider the Bill which has been introduced into Parliament, authorizing the Company to raise further capital and construct new reservoirs and other works. The Chairman (Mr. F. James) explained that the entire existing capital of the Company had been expended in works; and they could not at present put down another single service without more money, which they were going to Parliament for power to raise. It was primarily a money Bill, and would have been so entirely had it not been necessary, when going to Parliament, to do certain other things which time and circumstances showed to be necessary. When they first went to Parliament in 1853, they asked for capital to the extent of £160,000, with necessary powers to make it up to £200,000. Yet in 1893 they had spent within £50,000 of half a million of money. The shareholders would therefore understand that the district they supplied was one which made it evident that the capital account never would be closed. But while the £160,000 produced scarcely any revenue, the half a million had produced a tolerably good one. Referring to the differential rating which existed in respect of the old Dudley district, the Chairman said an arrangement had been come to for terminating that within a specified period; and provision was made in the Bill for ratifying the agreement and making the charges at Dudley uniform with those in other parts of the district. Arrangements had also been made for terminating the overlapping which by some means had occurred between their Company and the Stourbridge Water Company. With respect to the new works it was proposed to undertake, he said they included a new service reservoir on the top of Barr Beacon, which could now be made effective in consequence of the pumping-stations they had erected at Shenstone and Bourne Vale. The district supplied by the Company extended to upwards of 40 miles in one direction, and 19½ miles in another; but the new reservoir was not required for one special district or locality, but would be used for all. Power was also sought in the Bill for consolidating the stocks; but the arrangement would be such that holders of £80,000 of 5 per cents. would, if converted into £100,000 of 4 per cents., still receive the same amount in interest. Although the Bill was such a small and comparatively harmless one, they were already threatened with opposition on the part of the Corporations of Walsall, West Bromwich, Wednesbury, and Sutton Coldfield. In the case of the last-named town, he thought the opposition was particularly vexatious, because, after the Company had been compelled under threats to supply Sutton with water, the Corporation of the latter place now wanted themselves to undertake the supply in Sutton itself, leaving only the outer and non-remunerative district to the Company. Sutton also complained that the present supply was inadequate; but it was in order to meet any difficulty of that kind the Company were proposing to erect the reservoir on Barr Beacon. It was the same with respect to the Walsall Corporation; but the Company could never submit to dismemberment of that kind. In 1859, long before the Company ever had a single service-pipe, they offered every local authority to provide the water in bulk, and to allow the authority to distribute it, but the offer was refused; and yet they now proposed to impose upon the Company a fixed price for water for "other than domestic purposes." If those people would fix the price of coal and labour, and everything that entered into the cost of production, the Company would be glad to fix a price for the water. He then moved that the Bill be approved. Mr. J. N. Brown seconded the motion, which was unanimously carried.

The Proposed Electric Lighting of Singapore.—Reference was made to this matter in the JOURNAL for Dec. 27 last. It may be remembered that an offer had been made to supply a certain number of arc lamps for lighting a portion of the town on the Thomson-Houston system for a month, at a cost of about $1000. We learn that the Municipal Commissioners have declined to accept the offer; one from the Singapore Gas Company as to the public lighting being expected.

THE METROPOLITAN WATER SUPPLY COMMISSION.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH *Commissioners.*)

Twenty-eighth Day—Tuesday, Feb. 14.

Mr. *J. H. Shoveller*, of the Statistical Department of the Registrar-General's Office, produced tables which he had prepared, under the guidance of Dr. Ogle, with reference to water supply and population. The number of supplies in registration London was 599,370, and the population was 4,211,743; giving a proportion of 7·03 persons per supply. In the 37 extra-Metropolitan parishes wholly supplied by eight Water Companies, the number of supplies was 153,196, and the population was 872,640; the average being 5·70 persons per supply. In the 52 extra-Metropolitan parishes partly supplied by one or more Companies, there were 26,492 supplies; the average number of persons per supply being, as he calculated, the same as in the other parishes—viz., 5·7. The total result gave 779,058 supplies to 5,235,387 persons, or 6·72 persons to each supply. In that portion of water-London—that is, the area of the eight London Water Companies lying outside Greater London—there were 92,313 acres, with a population in the year 1881 of 63,543, and in 1891 of 76,041, or an increase of 19·7 per cent. in the decennium. Assuming that rate of growth to be continued in the future, the population in 1921 would be 130,899; in 1931, 156,645; and in 1941, 187,455. Assuming that the future rate of growth of Greater London was in the same ratio as in the last 50 years, in the middle of 1891 the population would have been 5,659,428; in 1921, 9,854,284; in 1931, 11,855,210; in 1941, 14,262,430; in 1951, 17,158,435. But if they took the ratio of increase for the last 40 years, then in 1891 it would have been 5,659,540; in 1921, 9,877,905; in 1931, 11,893,036; in 1941, 14,319,261; and in 1951, 17,240,444.

The CHAIRMAN said he understood that the decennium from 1881 to 1891 was the first period that showed a relative decrease in the rate of increase.

Witness said he could not state off-hand if it was so. It was difficult to say that the increase would go on indefinitely; for, as the population reached a certain density, the rate of increase lessened.

Mr. *W. J. Dibdin*, Chemist to the London County Council, gave further evidence with regard to the quality of the water supplied by the Companies. He said that a continued examination of the waters of the rivers had shown that the large reductions in the amounts of impurities were not due to any specified improvement in the unfiltered supplies, but that the Companies had found themselves better able to deal with flood waters than formerly—a result which he presumed had been brought about by the attention called to the matter, which, in his opinion, strongly pointed to the advantage derived from a systematic examination of the water by some efficient authority. Although the water at the intake which the Companies had to deal with had returned to a condition similar to that in which it was in the storm period twelve months before, the quality of the water supplied had undoubtedly been of a superior character.

Professor DEWAR: I understand that you produce diagrams and analyses to the Commission, in order to show that the exceptionally bad condition of the water which it was admitted did occur in October and November, 1891, as represented in the report of General Scott, and also in Dr. Frankland's report to the Registrar-General, has not been repeated?

Witness: No; not to the same extent.

Further, do I understand that, while the unfiltered water has actually been worse than it was then, the filtered water has been better?—That is so.

Have you any explanation to give to the Commission how this large and material improvement has been effected?—I can only ascribe it to what would undoubtedly happen, looking to the fact that the Water Companies are simply a collection of gentlemen of ordinary human nature, and that, when particular attention is called to a condition of things, they would undoubtedly do all they possibly could to remedy it. It is only what one would expect that, when something wrong is pointed out, they would use every exertion to put it right; and it shows that they have been able to do it. It also proves the necessity for attention being called to these things, in a thoroughly impartial manner, by some authority whose duty it is to do so.

From a scientific point of view, I understand you see no reason why this high standard may not be maintained?—No; I certainly see no reason. I can see a great deal of reason why it should be much further improved; and on that point I will refer presently to the proposals for storeage reservoirs in the upper portion of the Thames. The analyses I have produced show an improvement of 33 per cent. in the organic element; while in the albuminoid ammonia, it is 50 per cent.

I think on a former occasion you were rather of a view that it would be impolitic to impound flood waters, even as a temporary expedient, for further increasing the supply?—Unless specific precautions are taken in order to secure that the impounded water is as free from pollution as it can possibly be obtained; but that, under the present sanitary conditions of the drainage or collecting area, would be very unsatisfactory.

If the present flood water was impounded, and treated in the same way as the water is now, do you see any objection to that water?—I cannot say that I see any objection to it on the score of health, except a very strong sentimental objection that undoubtedly we should, in a large number of cases, be drinking the sewage of the population in the valley of the Thames, and that in many instances it would come down as untreated sewage.

Then do I understand that, while you are bringing forward these figures of an improvement of 50 per cent. and 33 per cent., and stating that the flood water is better dealt with than it has ever been, you still entertain a much stronger view on the sentimental side, apart from the scientific side of the facts?—I think that must be so; that is so.

So that, even though this water could be much improved, I understand you would, apart from your analytical results as a scientific man, rely upon the sentimental side?—Because I do not see that it would be possible for anybody to say distinctly that the water, as we have had it supplied during the last six months, is not a water which might

be suspected of creating or giving rise to disease. I cannot see any evidence of that.

Not dealing with the biological side now, but purely with the chemical result, do I understand that to be your interpretation of it?—I should have to say that those waters would be perfectly free and wholesome, apart from anything on the sentimental side.

It is clear, is it not, that the results which you have described can only have been obtained by a much more efficient filtration?—I think that is the presumption. Of course, I have no means of knowing actually how they were attained—whether by longer storeage or by more efficient filtration, or whether (as it may have been, so far as I know to the contrary) by a larger use of well water. Still, however it was done, the Companies do, on the whole, supply a better quality of water. The improvement applies particularly to the Southwark, the New River, and the East London Companies. The New River water came out very bad at first. None of the Companies are worse than they were. The West Middlesex and the Chelsea are also much improved. In the matter of colour, there was a considerable quantity all round. But the Southwark and Vauxhall, the Grand Junction, the West Middlesex, and the Lambeth Companies' waters are all greatly improved; and, indeed, they seem to have been better all round in that respect.

Mr. MANSERGH: Do you think that any addition that could be made to the supply from wells would produce the difference you find?

Witness: Undoubtedly it would dilute more or less impure water; and with a purer water, you could get a better condition of things. I know that the Southwark and West Middlesex Companies have no wells; but the New River have wells very largely. It would be difficult to say, unless one knew the relative proportions, to what extent this improvement was due to wells.

Mr. HILL: You spoke of the improvement which has taken place during the last 15 or 18 months in the supply of water. Now, do you think, supposing there were a systematic examination of all the pollutions in the watershed, and a regular inspection were to take place, with a large increase in the storeage of water, the improvement would be continued?

Witness: I think the improvement would be very considerable and continued by a more thorough supervision of the sanitary condition of the collecting area; and on that point I should like to lay before the Commission a memorandum which I have prepared as to the reservoirs proposed on the River Windrush:—

The information obtained by the examination of samples of water, &c., taken from the tributaries of the Rivers Thames and Lea has been most conclusive, especially so in the case of certain pollutions which have been found to be exceedingly foul. This result is important in connection with the question of the formation of storeage reservoirs in the upper portion of the Thames Valley, as suggested by the Thames Conservators, and also upon the works proposed by the London Water Companies for providing nine storeage tanks at, above, and below Staines. It is very evident that this question of pollution must be carefully considered, especially in the case of reservoirs Nos. 1 and 2, which are proposed to be placed at the head of the River Windrush. From the examination of the Emms Ditch, which discharges into the River Windrush near Witney, evidence of pollution with strong sewage is abundant. There can be no doubt that, if the system of collecting water from drainage areas, such as those indicated in the plan, be carried out, a preliminary survey should be made of each of the areas in question, and the most stringent measures taken for the removal and prevention of all sources of pollution; otherwise gross matters will be collected from such drainage areas, and carried into the reservoir. Further, it is of the utmost importance that the method of conveying from these reservoirs into the Thames should have careful consideration, as, if it is proposed to allow the reservoirs to empty themselves into the streams, and thus be carried on to the main river, they will merely act as barriers of the pollution of the various towns on their route. The consequence of this would be even more objectionable than the present system, and the fresh sewage would be carried direct to the river; thus allowing less time for oxidation, &c. As a further precaution, I would suggest that, before the water is admitted into the storeage reservoirs, it should receive a rough filtration through gravel beds, in order to prevent the admission of undoubted particles of polluting matter. This, of course, would be only a preliminary rough treatment; but, nevertheless, it would no doubt exercise considerable influence by increasing the rapidity with which the water of the reservoir would recover from its pollution. It will be seen, from these considerations, that the whole of the district which would be affected by these storeage reservoirs should be under the most strict observation by an authority whose interests are involved. From the results which I have already had the honour of submitting to the Commission, it would appear that the powers of the Thames Conservancy have, no doubt from uncontrollable causes, been exercised in a very inefficient manner; and I would submit that it is not desirable that a question affecting the health of the inhabitants of London should be entrusted to a supervision which has been found wanting. It must be acknowledged, apart from all biological considerations, that the admission of crude sewage into the drinking water supplied to the Metropolis must be most objectionable, and should be prevented by means of proper restrictions, exercised by an authority having power to enforce its regulations.

I submit that the results already in evidence as to the pollution of some of the tributaries and various streams discharging into those tributaries have shown that there is gross sewage going therein, and that this would be carried by continuous supply from a storeage reservoir into the River Thames, and so be brought down. I further submit that there is not the slightest reason why that gross sewage should be permitted to go in; and that, if it is proposed to have storeage reservoirs, it is imperative that the utmost possible precautions should be taken to prevent the sewage existing. There is no reason why it should be. There are plenty of means of keeping it out, and of disposing of it in a harmless manner; and I venture to draw the attention of the Commission more particularly, in a very pressing way, to that point.

Replying to Professor DEWAR, as to the condition of the watershed of the Thames, witness said it was not a manufacturing district nor did he know of any coal or minerals, or anything likely to attract the concentration of population in that valley. The analyses at the present time showed that, even with the gross sewage pollutions, the water as delivered, when examined thoroughly by a chemist, was such as he would pass as a wholesome and pure water. Consequently, the remedial agents which he proposed were for relieving the river in future, and for obtaining the very best result. It was to guard against the possibility of the river becoming worse in the event of any further concentration of population.

Professor DEWAR: On a former occasion, when I asked you about the storeage of the flood water in the Thames, you hesitated very much as to whether that water could be used at all?

Witness: I said it was a matter of time.

Your former evidence led me to believe that you were very doubtful whether the Companies could ever deal with flood water at all?—I do not remember that I conveyed that impression.

Then latterly, when the question of the storeage of that water was dealt with, you admitted that the longer it was stored, the safer it would become?—That is so.

Consequently, even if these flood waters as they are at present were impounded, the longer they were impounded, the safer they would become irrespective of any filtration?—That is so in suitable reservoirs.

So that these suggestions with regard to the inspection of the particular district where the water is to be collected in these storeage reservoirs are to prevent unnecessarily bad water being collected?—That is so.

With respect to the particular stream you refer to as being so grossly polluted, have you traced the origin of that pollution?—No; I think it is entirely household sewage. The Windrush takes the sewage of the people of Witney. I do not know whether the area is outside the powers of inspection of the Thames Conservancy, or whether it is a pollution that can be suppressed under their powers.

In further examination, the witness said that, although localized areas were exceedingly bad, the whole of the flood water of the district had not reached such a state of impurity as gave him any fear at present. As to the question of the washing out of the Thames Valley, and whether the river would become worse with time, he said that, since he last gave evidence, he had obtained some information which he thought had considerable force on this point. During the last eight years, from 1885 to 1892, he had had daily examinations made of the river water at Crossness, both at high and low water; and, among those determinations, they had, of course, taken the chlorine, which would represent the amount of sea water. It was obvious that, when they had a very large quantity of chlorine running up to half that present in sea water, there could not be much land water coming down; and when the chlorine fell to a minimum, the river was filled with perfectly fresh water. As this passed away to the sea, and the sea water gradually came up again, his point was that it would show that the water that had been washed down had run from the valley of the Thames, and had simply gone away, and the valley had been drained dry. Then, in the course of time, they had a second flood period; and so they had a succession of washings out of the valley of the Thames. Having shown diagrams illustrating this, witness said they would prove at once that the River Thames undoubtedly had an annual washing out; and if the various pollutions that went on in the river were prevented, they might reasonably expect soon to have a very different condition of water in the Thames than at present existed.

Mr. *R. Bodmer*, Public Analyst for St. Saviour's and Bermondsey attended, at the request of the Board of Works, to support a complaint which they had forwarded to the Commission as to the quality of the water supplied by the Southwark and Vauxhall and Lambeth Companies. He stated that, from the results of his analyses, he thought he was justified in saying that the water supplied by the former Company was almost invariably the worst of any of the London water supplies during the year.

The CHAIRMAN: That, of course, is a matter of comparison between one Company and another, which we shall have to look into from the general returns and analyses extending over a long period of years which have been given to us. But your Board of Works and yourself specify certain isolated analyses of certain samples; and I understand that you come to speak to these. What is the conclusion you wish us to draw from them?

Witness said the conclusion he hoped the Commission would draw was that, on certain occasions, the water supplied by those two Companies was certainly not in a condition for a public supply. The samples were taken by the Sanitary Inspectors from Oct. 7, 1891, to Feb. 2 of this year. The bottles were supplied by the witness to the inspectors, after being carefully cleaned, in the usual way, by rinsing with sulphuric acid and thoroughly washing out. The samples were taken from stand-pipes at cab-ranks opposite the Hop Exchange, and also opposite Christ Church in the Blackfriars Road, in the same way as the samples for the Local Government Board; but he did not know if the stand-pipes were at the dead end of a main or on the centre.

The CHAIRMAN: It would be consistent with your knowledge, would it not, that, if water had been standing at the dead end of a pipe for some time, it might not be a fair sample of what was in the circulating part of the main?

Witness agreed to this proposition; but he added that, as the stand-pipes were at cab-ranks, water was being continually drawn off; and therefore it was considered to be the fairest spot of any for taking a sample from. On one occasion, notice was given to the Water Company of the intention to take a sample.

The CHAIRMAN: Of course, we all agree that it would, under ordinary circumstances, be a fair thing to send such notice as would enable a water company, if they chose, to see the circumstances under which the sample was taken; but not long enough to give them the opportunity if they desired (and it is not in the least likely that they would), or for it to be possible for them, to put in water specially for the purpose of having it taken out.

Witness said that, when the Companies had known that a sample was going to be taken, they had flooded out the main through the fire-cocks, and allowed a considerable quantity of water to run away. He could not say how long it would take a company to send the water to the particular point from which the sample was going to be taken.

The CHAIRMAN: Supposing there was a filtered supply in a storeage reservoir sufficient to serve 12 or 24 hours, or whatever number of hours that reservoir supplied, it would be necessary, would it not, to run off the whole of that water before a company could get water which had been filtered for the purpose of being tested to the point at which it was going to be taken?

Witness said that certainly would be so. In September, 1892, he reported that both Companies' supplies were "decidedly impure, and required little more organic impurity to render them unfit for a public supply." He took the standard of albuminoid ammonia laid down by Professor Wanklyn, who classed a water which had 0·01 per gallon of albuminoid ammonia as coming under the head of dirty water, and therefore certainly unfit for a public supply. As regards organic matter, he took the late Dr. Tidy's standard—that a water requiring more than 0·1 grain per gallon of oxygen to oxidize the organic matter should be classed as a doubtful water. Although, of course, not bad, those conditions were dependent a good deal on the nature of the organic matter present. In November, 1892, the albuminoid ammonia was 0·01; and the oxygen required to oxidize the organic matter was 0·109, which was above Dr. Tidy's limit for doubtful water. On Feb. 2, 1893, the albuminoid ammonia in the Southwark and Vauxhall water was 0·013; and in the Lambeth, 0·011. The oxygen required in the case of the Southwark and Vauxhall water was 0·128; and in that of Lambeth water, 0·111. These figures, he maintained, were certainly very high.

Replying to Professor DEWAR, witness stated that he had not determined the organic carbon or the organic nitrogen.

Professor DEWAR: When you obtained these results, and condemned this water supply, did you compare them with the published results of the official analysts for the same date, and those of Dr. Frankland as submitted to the Registrar-General?

Witness: Yes; I believe I did.

Did they find anything similar to you in the amount of these impurities?—Their deductions were totally opposed to mine from their own analyses.

And you do not deny that Dr. Frankland and the chemists who are continually at this work have a very large experience in such matters?—Certainly.

And consequently it must depend upon the initial standard you follow?—Yes; and upon the actual sample that is taken.

No doubt; but I am assuming now that the sample is perfectly correct. It would then depend upon the inference that you draw from the standard you took. You took a standard that you tell us is Dr. Tidy's on the one hand, and Professor Wanklyn's on the other; on this you rely. You follow in their wake, and on that you condemn the water?—I do not think I condemned the water on that occasion. I was mentioning it as being very inferior, or words to that effect.

I do not think that an analyst could go very much farther than in the last two lines of your report, in which you say: "In my opinion, both samples are decidedly impure, and require but little more to be condemned as unfit for drinking?" Surely, you could not go very much farther than that?—No; that is quite true.

Now, I want to know if it is on the absolute amount of albuminoid ammonia and the oxygen required in these two samples of water on which you made that remark that you considered you were entitled to condemn the water to such an extent as to say that it was nearly unfit for drinking?—Well, you must have a standard of some kind, or else you cannot condemn any water; and if a certain standard is admitted on all hands to be a proper one, are you not justified, if that standard is almost reached, in saying that the water requires but little more to reach that standard to be considered unfit? I should not have said "unfit for drinking," but "unfit for a public supply" is what I really meant to have said. I certainly said too much in saying that it was unfit for drinking.

You put it as being "generally admitted;" but I thought you agreed a moment ago that you could not possibly interpret the results of the chemists, first of all who report weekly—namely, Professors Crookes and Odling, and Dr. Tidy at that time—and Dr. Frankland independently. You and the four chemists could not possibly have taken the same standard, as you do not agree?—They do not use the same method. Dr. Frankland and the analysts for the Water Companies employ the organic carbon and the organic nitrogen method; and therefore their results are not directly comparable with mine.

Then you explain this anomaly—that, while they are reporting that the water is sufficiently good, you are reporting that it is nearly unfit for drinking—by saying that this is due to the fact of the difference of method?—No; I will not say that it is entirely due to that. To begin with, the samples were not taken on the same date or on the same spot; and I maintain that, unless absolutely identical samples are taken, it is unfair to compare the analyses of one man with those of another.

You have heard to-day the evidence of Mr. Dibdin, who has had a very large experience in this question, and is a great authority?—Certainly.

I will read you what he says with regard to the element on which you rely, and on which neither Dr. Frankland nor the other chemists rely: "The albuminoid ammonia in like manner fell from about 0·012 to about 0·006, and the oxygen absorbed from permanganate in four hours fell from about 0·13 to 0·08 grains per gallon; while the colour of the water fell from 3·5 to 1·2." Now, Mr. Dibdin there does not suggest that, either in the one case or in the other, the water was anything like unfit for drinking. How do you explain that?—I cannot explain it.

You only explain it that your experience is decidedly opposed to the opinion of those persons who have had the largest experience?—No; I do not say that.

You differ, at any rate, from Mr. Dibdin, from Dr. Frankland, from Professor Crookes, from Dr. Odling, and also from the late Dr. Tidy.

The CHAIRMAN: As I understand, the witness contends that no comparison could properly be made unless identical samples were taken at the same time and place.

Professor DEWAR: He turns back and says: "I said so on the ground of having adopted an absolute standard." Now, I am giving a standard which Mr. Dibdin has taken with regard to the same element, but which does not appear in the analyses of Dr. Frankland, Dr. Tidy, or Dr. Odling—viz., the variation from 0·012 to 0·006 grain of albuminoid ammonia, and of the amount of oxygen absorbed from 0·13 to 0·08. In neither case does Mr. Dibdin suggest that the water is anything like unfit for drinking. I asked him to explain how it is that there are now five of the most eminent chemists on this question never suggesting such a thing; and he is bold enough to say that on the analyses of these two samples this water is nearly to be condemned as unfit for drinking.

Dr. *J. Heron*, Medical Officer of Health for St. Saviour's, also proposed to give evidence with reference to reports made by Dr. Stevenson and the Public Analyst for Battersea with reference to the condition of the water supply.

The Commission declined to accept secondary evidence; and they then adjourned till the following day.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held their monthly meeting on Monday of this week, and transacted one or two items of business which are worthy of notice, though it must be said that, since Mr. Wells left the Commissioners, there is not the same liveliness as of yore. Mr. Wells was, indeed, mentioned at the meeting, in connection with charges of fabrication of the monthly reports relating to the output from the Edinburgh works. The Works Committee had had the subject under consideration, and had adopted a motion appointing a Sub-Committee to inquire into the matter, and to write to Mr. Wells asking him to substantiate the charges or to withdraw and apologise for them, in preference to at once exonerating the officials referred to by Mr. Wells. It seemed to be in reply to that finding that a letter from a firm of Law Agents, containing a mild form of apology on behalf of Mr. Wells, was read. The writers stated that, as Mr. Wells left the Commission in October, he was not responsible for the language of the minute of the Commissioners' meeting of Oct. 31; that he did not make the allegation attributed to him; and that he was sorry that anything said by him should have been so misinterpreted. The Commissioners approved of the action of the Works Committee; and so the charges are to be inquired into. There was some talk of a nasty sort with reference to the amount of retiring allowance to be given to a labourer, who had been for more than 20 years employed in the gas-works, and who is now incapacitated from work. The Finance and Law Committee recommended 7s. 6d. per week. A recently-added member, with the new-born and often misdirected zeal which frequently characterizes such gentlemen, moved that the allowance be 10s. per week. In ordinary circumstances, such a piece of business should have been passed without comment. But this was an opportunity for "talking to the gallery" which the new member could not forego; and the subject had to be thrashed out and sent to a division, when the 7s. 6d. was agreed to. I cannot help thinking that the incident shows a curious cross in public life which is worth considering. There was a working-class representative urging the Commissioners to grant a retiring allowance equal to nearly half the amount of remuneration earned by this workman. Had the man been in the employment of a private firm, it is unlikely that he would have received anything in the way of a retiring allowance. He has no claim whatever upon the Gas Commissioners for any; and what they give him is entirely *ex gratia*. But having given him a retiring allowance, they cannot refuse one to the next man who comes before them in the same way. The Gas Commission may go on giving retiring allowances to disabled workmen; but how about the price of gas? If their workmen are to be treated to pensions, other workmen outside, who have no such provision in prospect, will have to provide them. The pensioning off of old servants is always a laudable act; but until social arrangements make it of common application, it is scarcely the thing to have a labour representative advocating the claims of a single favoured one as against the interests of the many. The Commissioners might do worse than consider the expediency of establishing a fund out of which retiring allowances could be paid. Another item which they had before them was a proposal by a Special Committee of terms upon which the vexed question of the lighting of common-stairs may be settled. The suggestion is that burners to consume from 1 to 1¾ cubic feet of gas per hour be provided; that residents in common-stairs shall pay the Corporations a fixed charge for keeping the lights burning from sunset to sunrise—the Corporations paying the Gas Commissioners for the gas consumed at the rate of 2s. 10d. per 1000 cubic feet; and that the residents shall light the gas in the stairs, and the Corporations extinguish it. In the case of tenements where the residents do not care to have the Corporations to extinguish the stair-lights, the charges will be about one-third higher. It looks like an anomaly that there should be a higher charge in the case where the people are to do the extinguishing themselves; but that is explained by the fact that, in the one case the Gas Commissioners will have the Corporations for creditors, and will have no trouble in collecting the rate; and it has also to be borne in mind that the prices submitted were only for the gas, and that the Corporations will be entitled to charge extra for the cost of extinguishing.

I am exceedingly sorry that in my last week's "Notes" I should, relying upon a statement by Mr. Kinloch Anderson in the Edinburgh Town Council, have stated that the gas supplied to the house of Mr. J. A. Robertson was from the Leith works. That turns out not to be the case; the gas is from the Edinburgh works. Of course, Mr. Kinloch Anderson did not mean to reflect upon the quality of the gas from Leith, but rather intended to show that Mr. Robertson was wrong in supposing that the gas he was supplied with was poor. It is a pity, however, that he should have founded his observation upon an error

Mr. J. M. Turnbull gave the concluding portion of his paper on the comparative cost of electric lighting and lighting by gas, before the Edinburgh Merchants' Association this week. He showed that in Glasgow, with gas at 2s. 9d. per 1000 cubic feet, the cost of the equivalent lighting for 1000 hours would be, for gas, 9s. 7¾d., and for incandescent electric lighting, £1 19s.—a difference in favour of gas of £1 9s. 4¾d. On the question of street lighting, he showed that the difference in cost was as between 35s. a year for a gas-lamp and from £20 to £27 for an arc lamp. He admitted that the light from an arc lamp was superior to that of a gas-lamp; but he considered that, in

view of the great extra cost, the community should, if they were to adopt electric lighting, have some idea of the price before embarking upon it. The same amount expended upon gas lighting, he said, would provide a lamp for every three yards of street. This is an illustration which will bring the matter home to everybody as forcibly as any I have ever heard. One arc lamp, he pointed out, was usually made to do duty for three gas-lamps. Suppose they were to retain the three gas-lamps, and to place between every two of them other two lamps—making seven gas-lamps in the same space as would be served by one arc lamp—the cost would be, with burners consuming 4 cubic feet of gas per hour, only £8 4s. 5d. per year; and the result would be much more suitable for street lighting. Mr. Turnbull gave an exposition of the position taken up by Mr. A. B. Gill, the gentleman who superintended the fitting up of the electric light installation in the Safe Deposit Company's vaults in London, with reference to the lighting of his own residence. Mr. Gill's statement, in the columns of the JOURNAL, was that, by using a gas-engine, he was able to produce current at 1¼d. per unit. In making that statement, however, Mr. Gill, he thought, either intended to deceive or was deceived himself; because the cost of the engine and plant, depreciation, repairs, and gas, to take no account of attendance, would entail an annual charge of £32 16s. 11d., whereas gas to produce an equivalent light would cost only £13 10s., which made a difference of £19 6s. 11d. in favour of gas. Mr. Turnbull said that he started the inquiry, some years ago, very much prejudiced in favour of electric lighting. The conclusion he had come to, however, was that it was only those who had an interest, in the shape of getting a fee or an order for machinery, who were promoting it; and that, though it was a very fine light, the user had to pay for it. It is almost needless to say that Mr. Turnbull's paper received but scant attention in the columns of the local press; and thus the community are left in absolute ignorance of the useful and convincing array of facts which he had collected for their benefit.

An exhibition of gas appliances, said to be the first of its kind on a large scale in Edinburgh, was opened on Monday night. The promoters are Messrs. Richmond and Co., Limited, of Warrington and London; but besides their own goods, they have admitted assortments of articles kindred to gas cooking by local firms. A good display is thus made; and it is satisfactory to know that the exhibition is being largely patronized. Cookery demonstrations are given twice daily by Miss Owen, of London, and they prove to be a great draw for West-end ladies.

The arbitration between the Glasgow Gas Trust and Mr. R. M'Alpine, the contractor for the excavation of the gasholder tank at the Temple gas-works, has ended in an award of £1760 as premium to Mr. M'Alpine, for the completion of the work before the contract time. The Trust invite tenders for the construction of five small locomotive engines for use in their Tradeston and Dalmarnock works. The engines are specified to weigh only 2½ tons each, and to be less than 6 feet in height to the top of the funnel.

The electric lighting installation in Glasgow has now been in use for a week. Up till Tuesday night, the gas-lamps were kept lighted, in order to obviate the awkwardness of a breakdown of the arc lamps; but on Wednesday night and since, the arc lamps have done duty alone. There is already a conflict of opinion as to the efficiency of the light. A good deal of criticism has been bestowed upon the form of lantern which has been adopted—a tall hexagonal lantern, glazed with irregularly corrugated glass; and Mr. Henry A. Mavor has found it advisable to write to the newspapers to point out that it is a lantern similar to those which are in use in London. He states that it has been adopted after 14 years' experience as the best for street lighting purposes; though he admits that there is a considerable loss of light, owing to the kind of glass used.

The Dundee electric lighting installation was brought partially into use on Monday night; and locally there is a good deal of jubilation over the circumstance that the Dundee Municipality have taken the lead in Scotland in the introduction of domestic electric lighting. The race between Dundee and Glasgow is thus a divided one. On Saturday last, the Glasgow street installation was turned on, but not the domestic. On Monday, a few houses were lighted up with incandescent lamps in Dundee, but the street installation is not quite ready. Both the Glasgow and the Dundee incandescent electric lighting systems are on the three-wire plan; and each of the Corporations have had a claim made upon them by the Westinghouse Electric Company, for royalty in respect of what is called the infringement of the patent granted to Dr. John Hopkinson, and which the Westinghouse Company are now the owners of. The Dundee Corporation have settled the matter by a payment of £200. In Glasgow, where the claim is for £2 10s. per annum per ton of copper laid down in the installation, it is proposed to obtain the opinion of Counsel before settling. It will be unfortunate if the Corporation should be landed in litigation upon the subject.

The employees in the Dawsholm and Temple gas-works in Glasgow, held their annual festival at Maryhill last night. The Manager (Mr. A. Wilson) presided. Some idea of the great extent of the works may be had, when it is stated that about 600 persons were present, and particularly when the remarks of the Chairman are taken into account. He said that, during the four winter months of this season, they had sent out from the Dawsholm works 792 million cubic feet of gas, as against 705 millions in the same period of last year. Their wages account for the four months amounted to £20,571, as against £17,190; and they had 925 men employed, as compared with 798. When all their extensions were completed, they would be able to make at Dawsholm alone 18 million cubic feet of gas per day. Mr. Wilson has a large business to look after; and he does it well, as, it may be added, he did the duties of the chair. Mr. Wilson is to be Chairman of the informal gathering of gas managers which will, as usual, be held in Glasgow next month.

The Police Commissioners of Lockerbie met this week to consider the question of the proposed extension of the gas-works, which has been occupying their minds for some time; but instead of coming to a decision upon the subject, they agreed to make inquiries into the working and results to be obtained by the use of the oil-gas plant of Mr. Young, of Peebles.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 4.

Sulphate of Ammonia.—Speculation was rife at the end of February whether the higher level of prices then touched would be maintained. It was said that the extreme prices had only been paid to complete engagements for February, and that these requirements being filled, a reaction would set in early in March. So far nothing of the kind is happening—the top prices of last month can still be realized without difficulty. It was argued for some time in these columns that the position did not warrant a decline; and it cannot be gainsaid that it is stronger than ever to-day. Supplies are getting alarmingly small; and it must be remembered that foreign consumers—*i.e.*, as far as the Continent is concerned—have been buying very little since the beginning of the year. It is a vital question to-day whether they will be obliged to come in before the end of the month, or whether they have been sufficiently supplied by contracts sold principally by the speculators. There can be no question that, under all circumstances, the demand will be maintained; and meanwhile the business with America and the Colonies seems to be in excess of last year. The tendency is all the more satisfactory since nitrate is not so strong as it has been; and sulphate is not affected at all thereby. As regards nitrate, it is, however, in a strong position; the visible supply at date being only 380,000 tons, against 510,000 tons at this time last year, and 560,000 tons in 1891. It is true the deliveries show at present a falling off compared with last year; but this is partly due to the weather, and partly to the waiting attitude of consumers, owing to the higher prices. To-day's value is 10s. and 10s. 1½d. Quotations of sulphate at the country ports are £11 and £11 2s. 6d. per ton.

LONDON, *March* 4.

Tar Products.—The "bears" having squeezed all the benzol they can get out of the weak-kneed producers, there is a chance that benzol, especially 50's, may see higher prices. It is reported that a very much better feeling exists in the aniline trade, and that the low prices which have recently obtained have cleared off the stocks which weighed the market. The announcement also, if true, that the Tar Committee will sell their make through one channel, will help the improvement materially. Anthracene remains firm; and its price will doubtless be kept until the end of the year. Solvent naphtha has been hanging fire; but one or two important transactions have been made in this article during the last day or two, which will largely relieve accumulated stocks. Pitch continues to be sold at current prices; and distillers are indifferent to the operations of dealers, who are attempting to manipulate this article. Creosote is weak; as also are salts and other common tar oils. Business has been done at the following rates: Tar, 12s. Pitch, 26s. Benzols, 90's, 1s. 9d.; 50's, 1s. 6d.; country ports, ½d. less. Solvent naphtha, 1s. 3d. Toluol, 1s. 4½d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1½d. Creosote salts, 20s. Carbolic acid, 60's, 2s. 4d.; 70's, 2s. 7d.; crystals, 8d. Cresol, 1s. 10d. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia.—The forecast of previous reports in this column are now being amply realized. Buyers are extremely urgent to cover speculative sales; and the value of sulphate has advanced to £11 5s., less 3½ per cent., although business has been done during the week at varying prices down to £10 15s. Stocks are low; and, if makers are prudent, sulphate should continue to improve. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The possibility of some general stoppage of work at the collieries being decided upon by the Miners' Conference at Birmingham on Thursday brought forward last week some extra weight of buying; but, as the result of the Conference shows, the great bulk of the collieries throughout England prefer to let matters, if possible, remain as they are. It is, however, very questionable whether, in the present depressed condition of trade all through, the next step will not be by the coalowners, many of whom have been seriously considering the absolute necessity of a reduction in wages; and the outlook is still one of uncertainty as to whether there may not be some very general stoppage of work, in the attempt which the Miners' Federation will no doubt make to resist any downward movement in wages. An extremely quiet demand is reported for round coal generally; and the commoner sorts become, if anything, still more a drug upon the market, with prices cut so excessively low, to effect clearance sales, that anything like definite quotations are scarcely possible. Best Wigan Arley coal is only in exceptional cases fetching more than 12s. per ton at the pit; second qualities of Arley and Pemberton four-feet scarcely average more than 10s.; common house-fire coals, 8s.; and steam and forge coals are nominally quotable at about 6s. 6d. to 7s. per ton at the pit. The better qualities of engine fuel have been moving off moderately; and for these, prices are well maintained. Burgy is quoted at 6s. to 6s. 3d.; best qualities of slack, 4s. 9d. up to 5s. 3d.; medium sorts, 3s. 6d. to 4s.; and common slack, 3s. per ton at the pit mouth. Good ordinary qualities of steam coal do not fetch more than 8s. to 8s. 3d. per ton, delivered at the ports on the Mersey; and in odd cases, sales are being made at as low as 7s. 9d. per ton.

Northern Coal Trade.—The defeat of the project of a month's stoppage of production, and the acceptance of a reduction of 5 per cent. by the Northumbrian miners, have removed much anxiety as to the future of the coal trade. There is a slightly better demand for coal in the North-eastern district—some of the ports that have been closed by ice being now open to trade. Best Northumbrian steam coals are generally quoted 8s. 6d. per ton f.o.b.; and second-class coals are from 6d. to 9d. per ton lower. Small steam coals are a little steadier. In gas coals there is still rather a limited demand; but with larger shipments, this will be in some degree counterbalanced. Prices of gas coals vary very much; but about from 6s. 3d. to 6s. 6d. per ton f.o.b. may be taken as the general quotation. Manufacturing coals are quiet; but deliveries are rather larger than they were. In coke, the demand is slightly less animated. For export, the price generally asked for good

Durham coke is 14s. per ton; but the shipments of late have been below the average. Gas coke shows no alteration in price; but with a reduced output, the production is more readily disposed of now than it was two months ago.

Scotch Coal Trade.—The trade in Scotland is still featureless. On the west coast, shipments are keeping well up; but on the eastern side of the country, with the exception of Grangemouth, there is stagnation. There is a disposition on the part of the men to object to the proposed reductions in wages, and the suggestion is made to organize a national fortnight's holiday, with a view to running down stocks. The coalowners are encountering very keen competition from the North of England, which keeps down prices. Still, though the price per ton is 1s. cheaper than when wages were last at their present level, buyers can scarcely be got for large quantities. Prices are still tending downwards. The quotations, f.o.b. Glasgow, are: Main, 6s. 3d. to 6s. 6d.; ell, 7s. to 7s. 3d.; splint, 7s.; and steam, 8s. to 8s. 3d. per ton. The shipments amounted to 108,558 tons—an increase upon the previous six days of 5796 tons, but a decrease upon the corresponding week of last year of 8295 tons. For the year to date, the total shipments have been 768,323 tons—a decrease upon the corresponding period of last year of 68,877 tons.

Reduction in Price at Yarmouth.—The Directors of the Great Yarmouth Gas Company have decided on reducing the price of gas to 3s. 2d. per 1000 cubic feet, with the usual discounts, from the 31st inst.

The Affairs of the Coventry Corporation Gas Committee.—The last quarterly report of the Coventry City Council Gas Committee discloses satisfactory progress in the gas section of their business. The number of consumers on Dec. 31 last was 6060; on Dec. 31, 1891, 5857—an increase of 203, or 3·47 per cent. The number of cooking and heating stoves on hire was respectively 1418 and 1367—an increase of 51, or 3·73 per cent. The length of mains was 48 miles 1721 yards and 47 miles 1443 yards. The quantity of gas made in the quarter ending Dec. 31 last was 104,866,000 cubic feet, as compared with 103,405,000 feet in the corresponding period of 1891; being an increase of 1,461,000 feet. In the nine months ending Dec. 31 last, 221,453,000 cubic feet of gas were produced, as against 215,725,000 feet in the nine months to Dec. 31, 1891—an increase of 5,728,000 feet, or 2·65 per cent. The gas-rental in the last quarter of the year was £13,177, as compared with £13,028.

The Corporation of London and the Water-Works Purchase Fund.—At the meeting of the Court of Common Council of the City of London last Thursday, the Chairman of the Commission of Sewers (Mr. Bridgman) asked the Remembrancer what had been the result of the working of the Acts passed in 1887, whereby after paying a dividend of 5 per cent. certain Water Companies were to hand all profits beyond that amount to the Chamberlain, as the trustee of a fund which was ultimately to be used towards purchasing the interests of the Companies. He also desired to know whether some amendment of the Acts was not required for more effectually carrying out the object in view. The Remembrancer (Mr. Goldney) said the total amount received up to the present was £2150, which had been paid by the Companies in South London; but notices had been given by other Companies with respect to the issue of debenture stock, and hopes were entertained that there would be a large addition to the sum paid over to the Chamberlain. Instructions had been issued by the County Purposes Committee to obtain an amendment of the clauses in the Acts relating to this matter.

Liability of Electric Lighting Companies.—Last Friday, at the Brompton County Court, before Judge Stonor and a jury, a case was decided on the Employers' Liability Act and Lord Campbell's Act. It was that of *'Lang v. The House-to-House Electric Lighting Company, Limited;* the plaintiff appearing as the widow of Thomas Piercy Lang, for the benefit of herself and two infant children. It arose out of the fatality at Brompton, of which particulars were given in the JOURNAL for Nov. 22 last (p. 913). Lang, it may be remembered, was a workman in the employment of the defendants; and he met his death while engaged in hauling electric wires into position after they had been slackened in order to make a connection between the main in the street and a private house. A very small portion of the india-rubber and other insulating covering of the wire was rubbed or broken off; and, his fingers coming into contact with a wire which was under high tension, he fell back, and died almost instantaneously from the shock. The jury found that there was negligence on the part of the defendants or their servants, and that such negligence caused the accident, but that the deceased was guilty of contributory negligence by not using the gloves provided by the Company. The Judge therefore entered judgment for the defendants, without costs. In the event of a verdict for the plaintiff, the damages had been agreed at £195.

The Supply of Hydraulic Power in London.—In the JOURNAL for Jan. 21 last (p. 184), we gave some particulars in regard to the plant established by the General Hydraulic Power Company, the Engineers of which are Messrs. Ellington and Woodall, of Westminster, for carrying on their operations. We learn from the last report of the Company that the working in the past year resulted in an increase of £5200 in the receipts for water, as compared with 1891. The dividend recommended by the Directors made, with the interim dividend, 6 per cent. for the year, with £381 to the good. With respect to the London undertaking, the number of machines contracted for up to Dec. 31 last was 1848, of which 1755 have been connected—an increase for the year of 206 and 252 respectively, which is quite up to the average of previous years. The consumption of power per machine was less than usual, owing, no doubt, to the general depression in trade. The Wapping pumping-station was completed during the year. The erection of the new pumping-station at the City Road Basin of the Regent's Canal is in progress, and is expected to be ready for work early next year. The Liverpool undertaking is making steady progress. The number of machines contracted for up to Dec. 31 last was 303, of which 276 have been connected—an increase during the year of 54 and 70 respectively. The expenditure in London during 1892 was £31,981, on account of the Wapping and City Road stations and additional mains. The expenditure in Liverpool was £4498, on account of plant and mains.

Sandgate in Darkness.—An extensive subsidence of land, involving great destruction of property, took place last Saturday night and early on Sunday morning at Sandgate, near Folkestone. The land has sunk in some places from 7 to 9 feet; and it is estimated that about 500 houses have been wrecked or more or less damaged. The water and gas pipes have been broken—some of the latter projecting 2 feet out of the ground. On Sunday night the town was in darkness; and the town crier was sent round to caution the inhabitants. Water was conveyed from house to house by means of carts. The phenomenon was at first ascribed to an earthquake; but it is now supposed to be due to recent heavy rains.

Postponement of Electric Lighting at Tunbridge Wells.—At a meeting of the Tunbridge Wells Town Council last Wednesday, the chief topic of discussion was the proposal to adopt the electric light in the borough. Alderman Clifford moved the confirmation of the report of Mr. Preece (upon which some comments appeared in the "Electric Lighting Memoranda" in the JOURNAL for the 14th ult.). The motion having been seconded, Alderman Cronk moved an amendment in favour of deferring the matter for two years. An animated debate followed; and, on a show of hands being subsequently taken, 14 voted for the amendment and 14 for the original motion. By the casting vote of the Mayor, the amendment was carried.

Penryn Gas Company.—According to a paragraph in a local paper, a prospectus has appeared of a new gas company at Penryn, which is to be started with a capital of £10,000, in £5 shares. We learn that the inhabitants have been somewhat astonished at the proposal, for, in the first place, they regard the capital as exceedingly large, especially in view of the fact that the works were purchased not long ago for about £700; and, in the next place, only one gentleman connected with the undertaking is known in Cornwall. It is acknowledged that a sum of £2000 has been expended on the works; still the capital is considered to be out of proportion to the value of the concern. The price now charged for gas is 5s. per 1000 cubic feet; and an opinion is strongly entertained that it could be lowered.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 402.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	"	7½	Do. 7 p. c	10	12—13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	5½—6½	..	6 0 0
40,000	5	"	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	21 Feb.	11½	Brentford Consolidated	100	214–218*	+1½	5 5 6
180,000	"	"	8½	Do. New	100	168–173*	..	4 18 3
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	42 — 4	..	5 4 6
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept	11½	British	20	42–44	..	5 2 3
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10		—	Buenos Ayres (New) Limited	10	7—8	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	99 –101	..	5 18 10
150,000	20	24 Feb.	8	Cagliari, Limited	20	24–26*	..	6 3 1
550,000	Stck.	14 Oct.	12½†	Commercial, Old Stock	100	244–249	+2	5 0 4
165,000	"	"	9½†	Do. New do.	100	182—187	+2	5 1 6
163,762	"	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	122—127	..	3 10 11
800,000	Stck.	15 Dec	13	Continental Union, Limited	100	227—232	..	5 12 0
200,000	"	"	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	193—195	..	5 2 7
486,090	10	27 Jan.	10	European, Limited	10	21—22	+1	4 16 11
354,060	10	"	10	Do. Partly paid	7½	14½—15½	+½	4 17 0
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	222—227	..	5 5 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	93—96	..	4 3 4
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	115—120	..	4 3 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	165—170	..	4 8 2
1,300,000	"	"	7	Do. H, 7 p. c. max	100	166—170	+1	4 2 4
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	260—265	..	3 15 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	152—157	..	3 16 5
1,061,150	"	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	122—123	+1	3 4 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	127—132	..	3 8 2
908,000	"	"	6	Do. 6 p. c. do	100	165—170	..	3 10 4
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	227—230	±1	5 4 0
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4½—5	+½	6 0 6
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	..	4 11 9
541,920	20	16 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	10	Oriental, Limited	5	7⅞—8¼	—⅛	5 1 2
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 7 4
166,870	10	—	2	Pará Limited	10	2—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	100–105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	9—10	+½	—
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	290–295*	+4	5 5 0
1,350,000	"	"	12	Do. B do.	100	241–246*	..	4 17 7
230,000	"	"	13	Do. C do.	100	245–250*	..	5 4 0
750,000	"	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	143—146	..	3 8 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	258—263	..	3 16 1
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	214—218	..	3 13 5
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	141—144	..	3 2 6
700,000	50	15 Dec.	8½	Grand Junction	50	108—111	..	3 16 7
708,060	Stck.	10 Feb.	11	Kent	100	277—282	..	3 18 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	238—243	..	3 18 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	195—200	..	3 15 0
285,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	125—130	..	3 1 6
500,000	100	10 Feb.	12½	New River, New Shares	100	323—328	..	3 14 0
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	131—134	..	2 19 8
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	161—166	+1	3 18 4
126,500	100	"	6½	Do. D 7½ p. c. do.	100	145—150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	257—262	+2	3 16 3

*Ex Div.

† Next dividend will be at this rate.

New Water Supply for Redruth.—A meeting of the ratepayers of Redruth was held on the 23rd ult., to consider the scheme which has been proposed by the Local Board for supplying the town with water. It is intended to obtain a supply from Gordon and Penstruthal and store it; and the total estimate for the works is placed at £10,000. A resolution approving of the project was carried.

A Gas Accident at Malton.—Three men had a narrow escape from suffocation at the Malton Farmers' Manure Works last Saturday week. The Company have recently put down plant on the Dowson system for manufacturing their own gas to drive the engines and machinery; and, when at work on Saturday morning, a pin or bolt came out. The engineer in charge—a man named Wilson—endeavoured to replace it without stopping the engine, and the gas-bag burst. The engineer was overcome by the fumes; and, on the fireman at the mill going to his assistance, he also was overcome. A third man shared the same fate; but, on the alarm being raised, the men were rescued, and subsequently recovered. Wilson was severely burnt about the legs.

The Teesside Water Supply.—Yesterday week, a conference of the Stockton, Middlesbrough, and Thornaby Corporations was held, for the purpose of considering the subject of the price charged by the Water Board to large consumers of water. Mr. Samuel (Stockton) moved—"That this joint meeting of the Stockton, Middlesbrough, and Thornaby Corporations is of opinion that, owing to the present and prospective deficiency in the revenues of the Water Board, the time has arrived when action should be taken by the Board with a view to increasing the price of water to the large consumers, who are supplied at 3d. per 1000 gallons." In support of the resolution, he said it had been stated over and over again that, if they were to increase the price to the large consumers, the works would be ruined; for the cost would be so great that they would have to be closed. Since the water undertaking had been taken over by the Corporations fourteen years ago, a loss of £151,000 had been sustained by supplying the large manufacturers at 3d. per 1000 gallons. This loss had fallen upon the three boroughs, and had had to be made up from their funds; so that the ratepayers, in having to make up that deficit, suffered an additional tax on account of the manufacturers being supplied at such a low rate. Alderman Bainbridge (Middlesbrough) seconded the motion, which was opposed by the Mayor of Thornaby, Alderman Hugh Bell (Chairman of the Water Board), and other gentlemen. The resolution was rejected by a large majority.

New Joint-Stock Companies.—Under the title of the Overton, Bangor, and District Gas Company, Limited, an undertaking has been formed, with a capital of £1000, in £1 shares, to acquire the gas-works at Overton, Flintshire, now owned by Mr. L. G. Russell. The Yeadon American Gas-Retort Syndicate, Limited, with a capital of £2000, in £5 shares, is to acquire certain patents relating to improvements in retort-furnaces, and to develop and work them. Among the first Directors are Mr. J. A. Yeadon and Mr. W. Adgie.

The Purchase of the Stourbridge Gas-Works by the Town Commissioners.—The Stourbridge Town Commissioners held another private meeting with reference to the purchase of the gas-works on Monday, the 20th ult. It is understood that there were two matters under consideration. First, the Gas Committee desired to obtain the sanction of the Board to an application being made to the Local Government Board for permission to borrow £5000 as working capital. This is not in addition to the £120,000 which the Board have power to borrow, but is included in that amount. Secondly, the Committee wished to be empowered to bid a price for the gas-works, and also to join with the Gas Company in appointing an arbitrator, or to appoint an arbitrator separately, if an agreement as to price could not be arrived at. The sanction asked for was granted. A correspondent of a local contemporary refers as follows to the subject: "The sum of £3450 is the amount the Company pays in dividends on all its share capital. If the Commissioners buy the works at twenty-five years' purchase, the amount will be £86,250, to which must be added £9250 loan capital; making a total of £95,500. If 28½ years' purchase is paid for the works, then the amount required, including loan capital, will be £107,821; and if thirty years' purchase is the award of the arbitrators, then the purchase-money and loan capital will be £112,750. To either of these amounts would have to be added £5000 as working capital. It is proposed to borrow the money at 4 per cent., to be repaid in forty years; the Commissioners having, however, the power, at the end of ten years, to make other arrangements as to the loan. The following figures show the amount of the annual payment on the several amounts stated at 4 per cent. for forty years: Loan of £100,000, at 4 per cent., £5052; £105,000, £5304; £110,000, £5557; £115,000, £5810; and £120,000, £6063. The profit made by the Gas Company in 1892 was £4389. The £9250 loan capital has been reduced nearly £4000 by the sale of the Mersey Wheel-Works to the Great Western Railway Company."

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

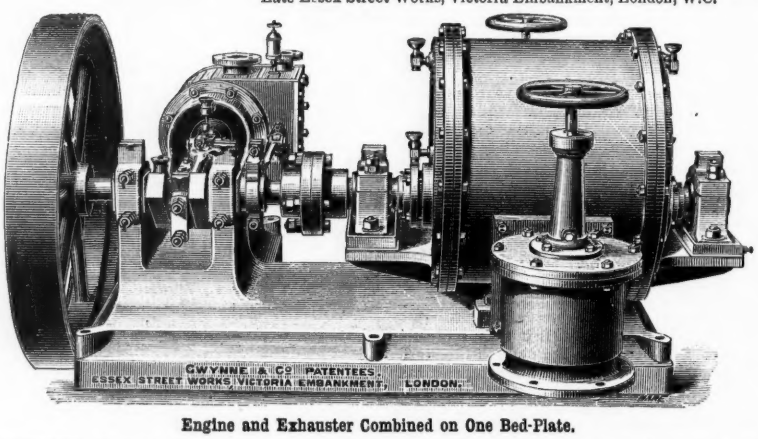
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 393 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to MR. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical
Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

WANTED, employment (temporary or otherwise) in Town or Country, as DRAUGHTSMAN in Gas-Works or Offices of Gas Engineer. Experienced in Designing, Specifications, and Quantities.
Address W. C., 4, Barbot Street, Hyde Lane, EDMONTON.

WANTED, by a competent Man (aged 40), a Situation as WORKING MANAGER in a small Gas-Works. Sixteen years' experience. Good Stoker, and experienced in Mains and Service laying, fixing Meters, and taking Indices of same.
Address No. 2207, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

JUNIOR Draughtsman wanted in a Gas Engineers and Contractor's Office.
Apply, by letter, with references and qualifications, and stating salary required, to No. 2200, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady Man as Stoker, Used to Shovel Charging. Preference given to one having a knowledge of Engine and Exhauster. Wages, 24s. per week.
Apply, with testimonials, to the MANAGER, Gas-Works, BEXHILL.

AGENT.

AN Established Firm are open to appoint a first-class AGENT or AGENTS, for London and Provinces, for the sale of a high-class quality of BOG ORE.
Applications only from first-class Firms, with established connections with Gas-Works, Chemical Works, &c., entertained. Liberal terms.
Address No. 2206, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a second-hand Sulphate STILL, about 2 feet diameter, and SUPER-HEATER.
Address HENRY TOBEY, GAS-WORKS, Malton, YORKS.

WHAT Offers for 50 or less number of £10 SHARES (£7 10s. paid up) in FLETCHER, RUSSELL, AND CO., LIMITED.
Address No. 2205, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON.

FOR SALE—Two Hydraulic Mains, 40 Oval MOUTHPIECES, ASCENSION-PIPES, &c.
For further particulars, apply to E. M. BEECHAM, Gas-Works, CIRENCESTER.

FOR SALE, cheap—Two first-class "METEOR" GAS-LAMPS. Were fitted new into a private house, but found unsuitable for small rooms.
Apply to JAMES HUDSON, PENRITH.

FOR SALE—Ten 16-inch round RETORT MOUTHPIECES, with Lids, and Ten 6-inch to 4-inch ASCENSION-PIPES.
Apply to the SECRETARY, Gas Company, Cannock, STAFFS.

FOR SALE—Rectangular Station Meter.
Capacity 19,000 cubic feet per hour; 12-inch Connections.
For particulars apply to W. E. PRICE, Gas-Works, HAMPTON WICK.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

EXHAUSTER FOR SALE.

ONE of Waller's Three-Blade Rotary EXHAUSTERS of 10,000 cubic feet per hour. Can be seen at work; being replaced by a larger one.
For further particulars, apply to Mr. COOPER, Gas-Works, Banbury, OXON.

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

ALDERSHOT GAS AND WATER COMPANY.

KIRKHAM'S Scrubber, with 8-inch Connections, and four 12 feet square PURIFIERS to be Sold.
Offers to be addressed to the HONORARY SECRETARY, at the Offices of the Company, 103, Victoria Road, ALDERSHOT.

FOR SALE—Two Purifiers, 15 ft. by 10 ft. with two 14-inch Four-way Valves and Connections (C. & W. Walker).
Two PURIFIERS, 20 ft. by 10 ft.
One 14-inch CENTRE-VALVE (C. & W. Walker).
The above are displaced solely through Extensions, and can be sold in one lot or separately.
Any further information may be obtained by applying to CHAS. H. KAY, Secretary, Gaslight Company, Douglas, ISLE OF MAN.

ON SALE—Exhauster (Beale's) 15,000 cubic feet per hour.
4 ft. by 12 ft. Square PURIFIERS, with Centre-Valve complete.
Two Sets of 4-inch CONDENSERS.
One 4-inch WASHER.
Three Small PURIFIERS.
4-inch SCRUBBER.
One 10-inch and one 5-inch METER.
Self-Sealing MOUTHPIECES and HYDRAULIC MAINS.
Address No. 2204, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MARSDEN LOCAL BOARD.

THE above Board invite Tenders for a TRIPLE TELESCOPIC LIFT GASHOLDER. The Diameter of the present Holder is 60 feet and depth 14 feet.
Parties tendering must furnish Specifications and Drawings, and state time in which they can complete the contract.
Tenders to be delivered to the undersigned on or before the 22nd inst.

JAS. C. FARRAR,
Clerk to the Board.

Marsden, near Huddersfield,
March 3, 1893.

CITY OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive, on or before Wednesday, the 15th day of March next, OFFERS of high-class CANNELS and COALS suitable for Gas Making, for delivery at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three Years.
Particulars and printed Forms of Tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order of the Gas Committee,
WM. HENRY TALBOT, Town Clerk.

Town Hall, Manchester,
Feb. 10, 1893.

THE Gas Committee of the Leeds Cor- poration are prepared to receive TENDERS for the supply of WET and DRY GAS-METERS, to be delivered at their Gas-Works during a period of Twelve Months from receipt of order.
Each party tendering is required to send, on or before Saturday, the 11th of March next, two sample Three-Light Meters (one of which is to be unscrewed for examination), and also list of guaranteed weights of Drums of all sizes, addressed to Mr. Lupton, General Superintendent, Gas-Meter Works, Dewsbury Road, Leeds, from whom Forms of Tender may be obtained on application at the Offices of the Gas Department Municipal Buildings, Leeds.
Tenders, addressed to the Chairman of the Gas Committee, at the latter address, will be received not later than Monday, the 13th of March next, endorsed "Tender for Meters."
The Committee do not bind themselves to accept the lowest or any tender.

CORPORATION OF ROTHERHAM.

THE Gas Committee are prepared to receive TENDERS for the supply of FIRE-CLAY, BRICKS, and RETORTS.
Specification and Form of Tender may be obtained from the Gas Engineer, Mr. C. B. Newton.
The Contractor whose tender may be accepted by the Corporation is required to pay his workmen (whether Artizans or Labourers) not less than the minimum standard rate of wages paid in Rotherham and District for the time being in each branch of trade, and to observe the recognized hours and proper conditions of labour.
Tenders to be delivered (sealed), at the Town Clerk's Office, Rotherham, not later than Monday, the 20th day of March, endorsed "Tender for Fire-Clay Goods."

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
Feb. 25, 1893.

SADLER AND CO., LIMITED,
MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

CALVERT'S MECHANIC'S ALMANAC for 1893 (price 4d.) contains, besides other valuable matter—"PATENTS: SOME POPULAR DELUSIONS," by W. LLOYD WISE, Esq., J.P., C.C., Fellow of the Chartered Institute of Patent Agents.
MANCHESTER: JOHN HEYWOOD, Deansgate; and JOHN CALVERT, 99, Great Jackson Street. LONDON: JOHN HEYWOOD, 2, Amen Corner, E.C.

CITY OF BELFAST.

THE Gas Committee of the Belfast Cor- poration invite TENDERS for the supply and Erection of RETORT-FITTINGS, including Mouthpieces, Hydraulic Mains, Ascension and Arch Pipes, Furnace-Doors, &c., &c.
Drawings and Specification, may be inspected at the Engineer's Office, Gas-Works, Belfast.
Copy of Specification, with Form of Tender attached, can be had on payment of One Guinea, to be returned on receipt of a *bonâ fide* Tender.
For the convenience of parties unable to inspect plans at the Works, it has been arranged to supply a complete set of Drawings and Specification on payment of Three Guineas (not returnable).
Tenders, endorsed "Tender for Retort-Fittings, &c.," must be lodged in the Town Clerk's Office, Town Hall, Belfast, not later than Wednesday, the 29th of March, 1893.
The Committee do not bind themselves to accept the lowest or any offer.

JAMES STELFOX, Engineer.

SOUTH SHIELDS GAS COMPANY.

TO METER MANUFACTURERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of DRY GAS-METERS required during the present year.
The Meters must be of best quality, and delivered at the Gas-Works, carriage paid.
The Directors do not bind themselves to accept the lowest or any tender.
Further particulars may be obtained at the Gas-Works on application to Mr. W. J. Warner, the Engineer.
Tenders, marked "Tender for Meters," to be delivered to the undersigned not later than Friday Morning, the 17th inst.

J. H. PENNEY,
Secretary.

Gas Offices: Chapter Row,
South Shields, March 4, 1893.

HORNSEY GAS COMPANY.

NOTICE is hereby given, that the Hornsey Gas Company offer for sale by TENDER £15,000 FIVE PER CENT. PREFERENCE STOCK, being the first portion of the £30,000 additional Capital authorized to be raised by Resolution passed at the Extraordinary General Meeting of Proprietors, held on the 17th day of February, 1893, in pursuance of the Hornsey Gas Order, 1884, and that they will be prepared to receive sealed tenders for such Stock not later than Twelve o'clock Noon on Saturday, the 18th day of March, 1893.
The amount to be allotted thereon must be paid up in full on or before the 30th day of March, 1893, after which date interest will commence to accrue.
In the apportionment of the net profits, after payment of the Debenture Interest, this Stock will rank with the £20,000 5 per cent. Preference Stock already issued, but before the whole of the Company's authorized Share Capital of £82,500, which is now fully paid up; and the Interest thereon will have priority of payment over all Dividends on such last-mentioned Capital, and will rank next after the Interest on the Company's Debenture Stock *pari passu* with the Interest on the Company's said Preference Stock.
The Interest on the Stock will be calculated half yearly up to the 31st of December and the 30th of June in each year, and be paid by Warrants issued immediately following the Half-Yearly Meetings of the Company, usually in March and August respectively in each year.
A deposit of £10 per cent. of the nominal amount of the Stock tendered for must accompany each tender.
Any amount, not being less than £5, or a multiple thereof, may be tendered for; and the Stock will be registered in the Company's Books, in the names of the allottees or their nominees, free of expense.
The minimum price below which no tender will be accepted has been fixed at One Hundred and Ten Pounds sterling (£110) for each One Hundred Pounds of Stock.
Particulars and Conditions of Sale, with printed Form of Tender attached thereto (upon which form only tenders will be received), may be obtained at the Company's Offices, No. 63, Chancery Lane, W.C., between the hours of Ten o'clock a.m. and Four o'clock p.m.

By order,
(Signed) S. J. WILLIAMS,
Secretary.

Hornsey Gas Company,
Offices: 63, Chancery Lane, W.C.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

ISSUE OF £18,800, OR LESS, 4 PER CENT. PERPETUAL DEBENTURE STOCK IN CERTIFICATES OF £100 EACH.

THE Directors will receive Tenders for this STOCK, on or before the 15th of March next, on forms containing particulars, to be obtained at the Company's Offices, 5, Great Winchester Street, London, E.C., and 77, West Street, Brighton; of Messrs. Howlett and Clarke, Solicitors to the Company, 8, Ship Street, Brighton; and of Mr. Ralph Homan, Stock and Share Broker, 2, Austin Friars, London, E.C.

By order,
W. H. HARDY.
Secretary.

February, 1893.

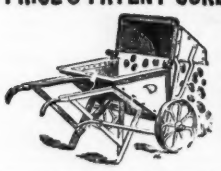
Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,

(*Established 1851,*)

Tar Distiller and Manufacturing Chemist,

WOLVERHAMPTON.

SCULCOATS, HULL.

THOMAS ILLINGWORTH,

NORTH DEAN CHEMICAL WORKS,

Near HALIFAX,

MANUFACTURER OF SULPHURIC ACID

OF EXTRA QUALITY FOR MAKING

WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE

Purchased for Cash against Delivery.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Danish Gas Company of London, Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

To effect a great saving in

GAS-FURNACES use our Special Derbyshire GANNISTER BRICKS.

ADDRESS

JAMES WHITE & Co., Limited,

ALBERT WORKS, WIDNES.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth,*
January 25th, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,
NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL**, received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13¼ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·51 CANDLES**, which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.,
QUAYSIDE, NEWCASTLE-ON-TYNE.

NEW BOX'S PATENT

RETORT-LID FASTENER.

CANNOT GET OUT OF ORDER.
DOES NOT DAMAGE LIDS.
SIMPLE & EFFECTIVE.
CHEAP & DURABLE.

For Prices and Particulars, apply to

W. W. BOX,

GAS-WORKS, CRAYFORD, KENT.

[*Illustrated Description in* JOURNAL, *Vol. LX., p.*346.]

ARMSTRONG'S PATENT

CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE.
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

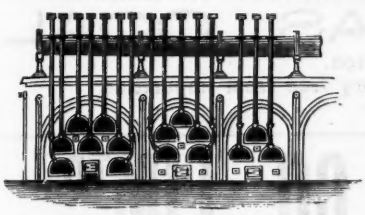
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

DEMPSTERS'



RETORT-SETTINGS,

RETORT-FITTINGS,

ELLAND.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

Note. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

Sheaf & Spring Works, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS.

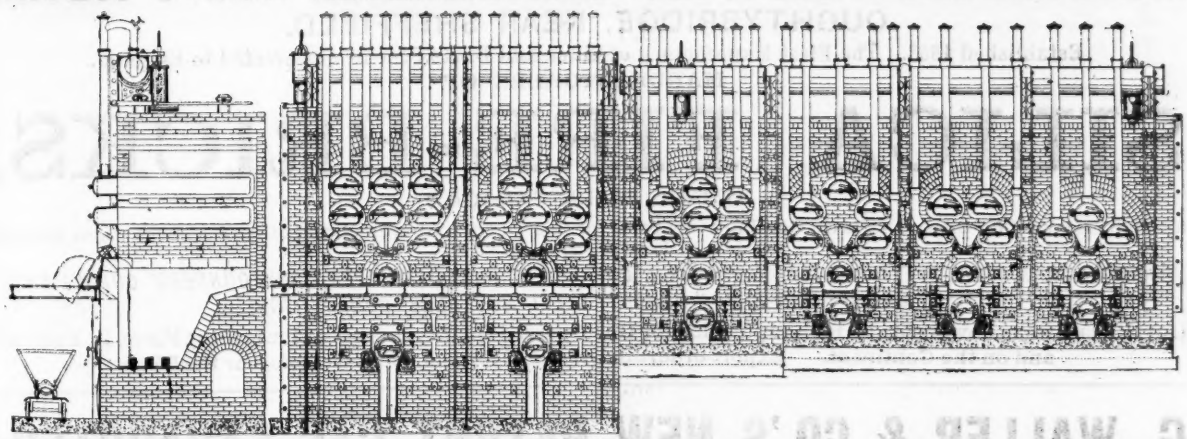
STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,

4, York Buildings, Queen Street,

EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

MEIKLEJOHN'S PATENT

Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

Is cheap and easily fixed to any form of main.

Will be found the most efficient appliance of the kind yet introduced.

Further particulars and price from

C. MEIKLEJOHN,

GAS-WORKS, RUGBY.

(Late N. MEIKLEJOHN, Longwood.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 12-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.

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THE SILICA FIRE-BRICK COMPANY,

OUGHTYBRIDGE, NEAR SHEFFIELD.

Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

MANUFACTURERS OF

SILICA FIRE-BRICKS,

(TRADE MARK "SILICA")

Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

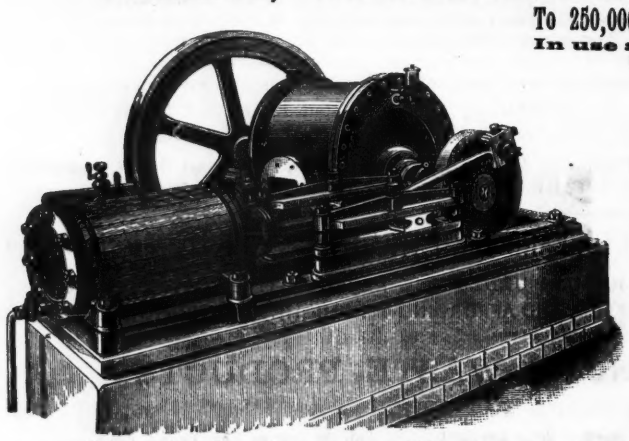
Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

G. WALLER & CO.'S NEW PATENT GAS EXHAUSTER.

MADE, with FOUR or THREE BLADES,

To 250,000 Cubic Feet per Hour, with or without Engine combined.

In use and on order for over 100 Works, equal to 3,850,000 Cubic Feet per Hour.



SPECIAL ADVANTAGES:

This Four-Blade Exhauster will pass fully 15 per cent. more per revolution than any other Four-Blade Exhauster with the same size cylinder, and with from 15 to 30 per cent. less friction or driving power, and without oscillation.

It will pass fully 50 per cent. more per revolution than any Two-Blade Exhauster, with very little increase in driving power for the increased delivery.

No other Exhauster gives such a steady gauge.

OLDEST MAKERS of BEALE'S EXHAUSTERS for 300 WORKS.

MODEL OF PATENT EXHAUSTER SENT FOR INSPECTION.

Patent Compensating Steam Governors. Special Tar-Pumps.

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GASHOLDERS

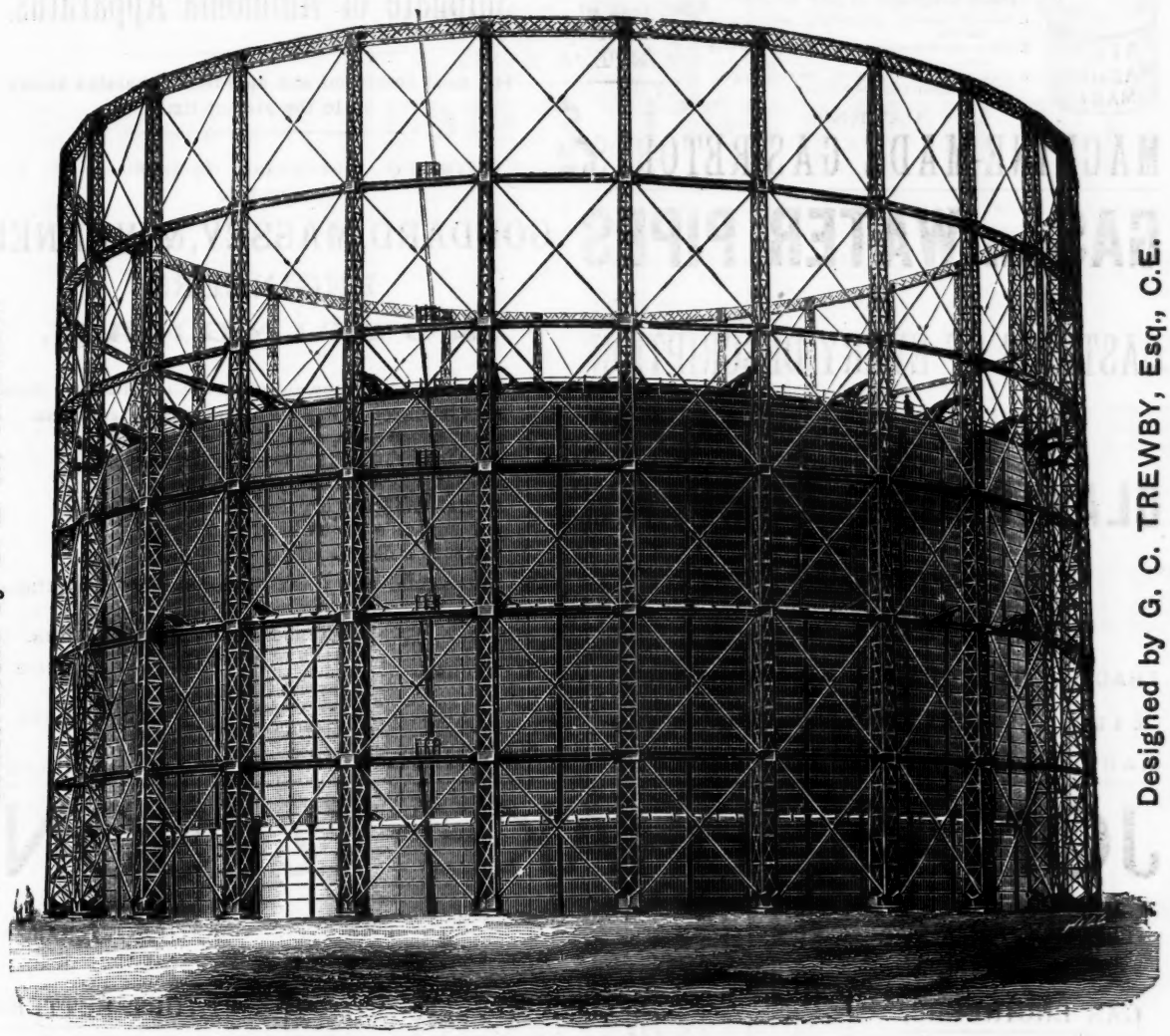
C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

Constructed by C. & W. WALKER.



Designed by G. C. TREWBY, Esq., C.E.

Four-Lift Gasholder, nearly 200 feet high, and 8 million Cubic Feet capacity, recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

PURIFIERS. SULPHATE PLANT.

Weck's Centre-Valve.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
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WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

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MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

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ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
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ANIMAL CHARCOAL CO., Limited, SHADWELL.
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ILKESTON.	BURY.	CHORLEY.
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NORTHWICH.	NELSON.	SALFORD.
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JONAS DRAKE & SON,

TELEGRAPHIC ADDRESS:
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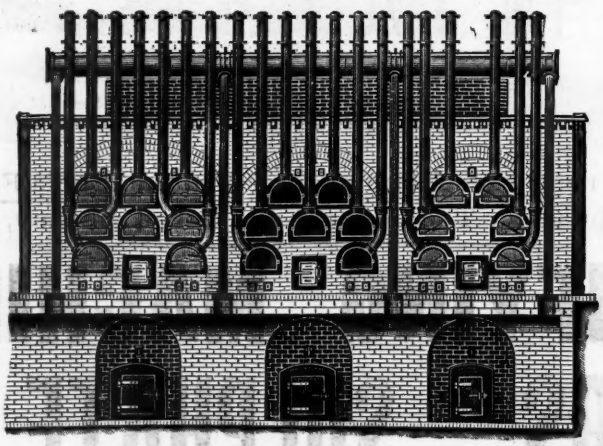
TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS
GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.

OVENDEN, HALIFAX.

DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

CARLESS, CAPEL, & LEONARD,

HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,

NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially prepare GASOLINE, specific gravity ·650; CARBURINE, specific gravity ·680; or any other Hydrocarbon best adapted for Carburetting Gas.

Prices and Samples may be had upon application.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

MANUFACTURER OF

A Special Compound for the cure of Stopped Ascension-Pipes. A couple of charges will clear a stopped Pipe, and an occasional charge keeps them clean; also increases the Make per ton and the Illuminating Power.

Prices and Particulars on Application. HEAD OFFICES: CORPORATION STREET, BIRMINGHAM. TELEGRAPHIC ADDRESS: "EVESON, BIRMINGHAM."

THE WATERBLEAN COLOR AND MINING COMPANY, MILLOM, CUMBERLAND.

TELEGRAPHIC ADDRESS: "WATERBLEAN MINES, MILLOM." PORTERAGE, 1s. 6d.

VENETIAN AND OXIDE REDS for the Manufacture of ANTI-CORROSIVE PAINTS.

Specially adapted for the Ironwork of Gas-Works and wherever subject to exposure.

G. J. EVESON, Proprietor, Corporation Street, Birmingham.

ORDERS TO BIRMINGHAM, OR DIRECT TO THE MINES.

R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

MAKERS AND ERECTORS OF

PATENT COLUMNLESS GASHOLDERS.

(COPY OF A LETTER RECEIVED)

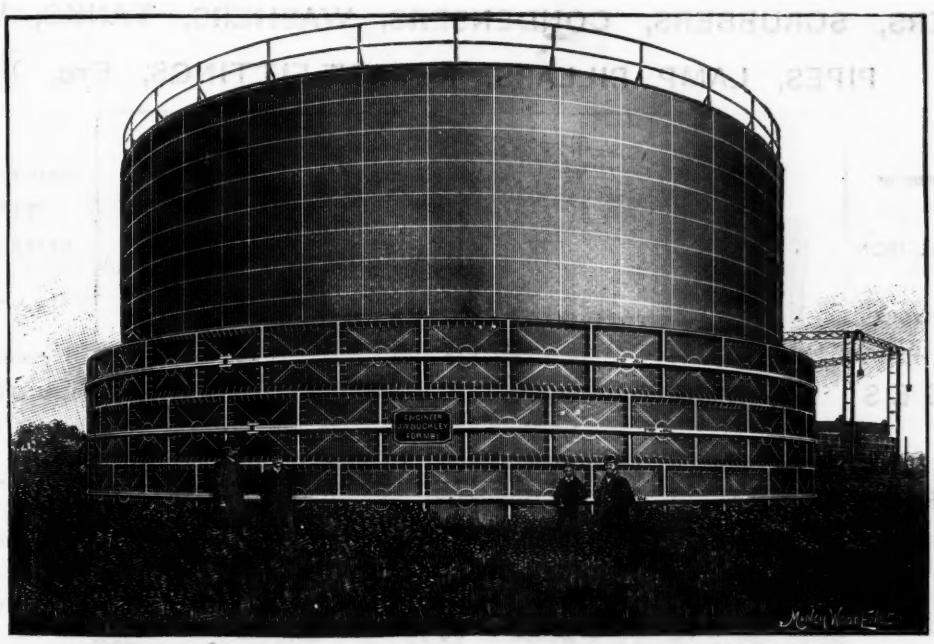
From **THE FORMBY GAS COMPANY, LIMITED, FORMBY, Nov. 11, 1892.** | *To* **Messrs. R. & J. DEMPSTER, MANCHESTER.**

GENTLEMEN,—I have pleasure in forwarding you a Photo., of the Spiral-Guided Gasholder and Tank which you erected for us last year.

You will be pleased to learn that it continues to work satisfactorily; the holder rising and falling freely, yet without any oscillation. Here we are situated on the coast, and exposed to the full force of the gales from the Irish Sea; but they have not the slightest effect upon the holder.

Yours truly,
J. W. BUCKLEY.

Telegraphic Address: "SCRUBBER MANCHESTER."



A Spiral-Guided Gasholder (prepared for telescoping), working in a Cast-Iron Tank made with planed joints.

Further Particulars and Estimates on Application.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

(FRANK W. CLARK, Engineer and Manager)

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

RETORT WORK

HORIZONTAL, INCLINED, REGENERATIVE, GENERATIVE, OR FLOOR-LEVEL SETTINGS.

J. & H. ROBUS,

ENGINEERS AND CONTRACTORS,

MANSION HOUSE CHAMBERS, 20, BUCKLERSBURY, LONDON, E.C.

ARE PREPARED TO ENTER CONTRACTS

FOR EXTENSIONS OR RENEWALS OF THE ABOVE WORK DURING THE ENSUING SEASON.

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED

FOR EXTENSIONS AND RENEWALS OF EVERY DESCRIPTION.

Contractors for the Erection of Gas-Works complete, including Gasholder Tanks of all sizes and Main Laying.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE,

MAKERS OF

GAS HOLDERS & GAS PLANT,

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES

PIPES, LAMP PILLARS. RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF

STRUCTURAL IRON

AND STEEL WORK,

BRIDGES,

ROOFS,

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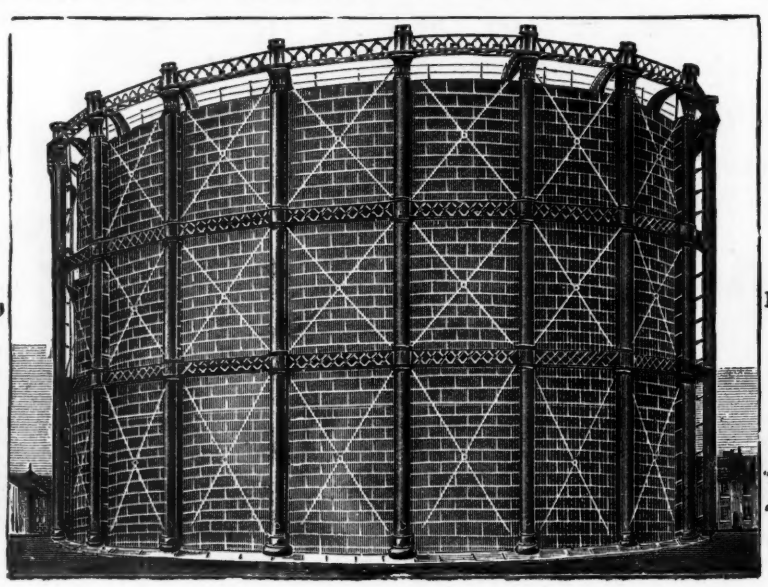

WORKS & HEAD OFFICE:

TIPTON,

STAFFORDSHIRE.

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LONDON OFFICE:

11, VICTORIA ST.,

WESTMINSTER.

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TELEGRAPHIC ADDRESSES:

"HORSELEY, TIPTON."

"GALILEO, LONDON."

OSLER,
BIRMINGHAM.

MANUFACTURERS
OF GASELIERS
IN GLASS AND METAL.

STEEL SCOOPS
FOR
RETORT CHARGING.

Scoops supplied with or without handles, and of any dimensions or shape required.

HENRY SYKES, Engineer,
66, BANKSIDE, LONDON, S.E.

TELEGRAPHIC ADDRESS "GAS LEEDS."

CLAYTON, SON, & Co.
LIMITED,
LEEDS,
MAKE
RETORT LIDS
OF ALL FORMS AND SHAPES
IN IRON OR STEEL
BY SPECIAL HYDRAULIC
MACHINERY.

LONDON OFFICE, 60, QUEEN VICTORIA STREET, E.C.

PRICES ON APPLICATION.

S. PONTIFEX & CO.,
GAS and WATER ENGINEERS,
Manufacturers of and Contractors for the Maintenance of
PUBLIC LAMPS & LANTERNS;
GLASS—Flint, Opal, and Bent in Stock, and Cut to Sizes.
WELL LAMPS, STREET NAME TABLETS,
LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS
LANTERNS COCKS, REGULATORS,
Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

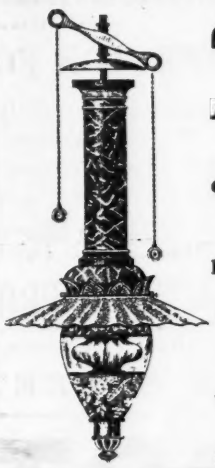
BROWN'S PATENT
LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF
BOX'S PATENT
PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.
Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

The Climax of Regenerative Gas Lighting!!



THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
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EQUILIBRIUM GOVERNORS, THE GASLIGHT AND COKE COMPANY'S VALVE-ROOM, STOKE NEWINGTON.

(TESTIMONIAL.)

THE GASLIGHT AND COKE COMPANY, 146, *Goswell Road, E.C., Jan.* 5, 1893.

GENTLEMEN,—In reply to your inquiry as to the working of the 36-inch and 24-inch Governors (double cone and equilibrium) recently erected by you at the new Valve-Station of this Company, situated at Stoke Newington, I beg to inform you they are highly satisfactory in their working.

The gas governed is supplied through a high-pressure pumping-main; and, notwithstanding the great fluctuations in the initial pressure, owing to so many stations pumping and shutting off alternately, the construction of your Governors enables a perfect equilibrium to be maintained, and being acted upon themselves by outlet pressure only, they stand the most severe tests to perfection.

I shall be happy to answer any questions, or show the Governors to Engineers contemplating their erection,

I am, Gentlemen, Yours faithfully,
(Signed) G. F. L. FOULGER, Distributing Engineer.

MESSRS. W. PARKINSON AND CO.,
Cottage Lane, City Road, E.C.

W. PARKINSON & CO., LONDON, BIRMINGHAM, MANCHESTER.

[See also Advt., p. 398.

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